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Construction of the Midway Gas Line.

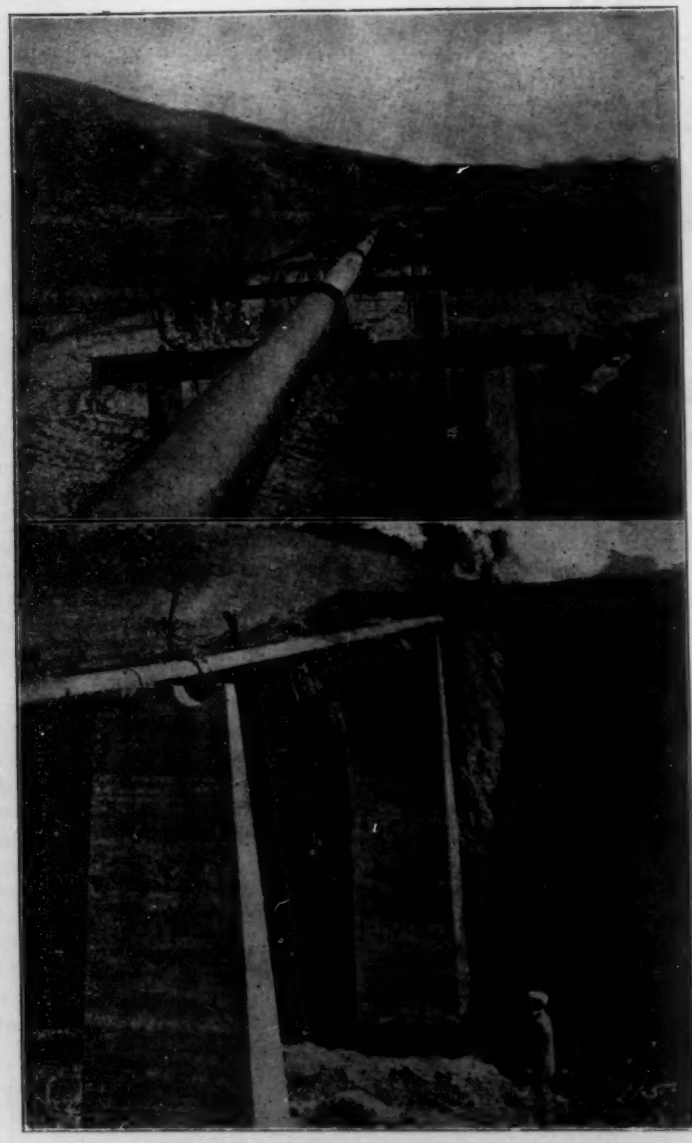
[By W. E. BARRETT.]

A huge pipe line transporting natural gas developed in the Midway oil fields in Kern county, across the plains and over the mountains to the city of Los Angeles, is described by the author in the San Joaquin Light and Power Company's Magazine. This line is the property of the Midway Gas Company, and in its completed form presents the realization of a project which has called for an immense amount of effort and preparation, and a fine brand of courage, on the part of those who made the enterprise possible. First of all, after the discovery of the gas field, it was necessary to determine if the underground supply was sufficient to warrant the expenditure of the large sum of money represented by the construction of this line, and the other activities contingent with putting the service into effect. A satisfactory report obtained after many months of hard effort, the next step was the selection of a route for the carrier. The geographic location of the extremities of the line are on either side of a rough and rugged portion of the Coast Range mountains, leading up to which are stretches of plain. Hence it was a certainty that the mountains would have to be crossed, and the problem was to find the most feasible and practical route. In the survey of this, and the construction of the line, a great many conditions were encountered which are not parallel in any other section of the country.

Imagine a line of pipe 12¾ inch in diameter and 112 miles in length, designed to operate under a pressure of 450 pounds, and laid to guard against any possible damage which might interfere with the steady flow of the vapor through it; strung across the hot level plains, and winding and twisting its way through and over the mountains, here and there bridging a stream or a gully; and the magnitude of the task is appreciated. At times when automobile trucks and wagons could not travel the steep mountain grades, as many as 1,200 head of stock were used to transport the supplies; water for the men and stock was hauled from 18 to 25 miles, and at times the camps were 80 miles distant from the nearest railroad station, and from 30 to 50 miles from the nearest habitation; 43 miles of road was built through the mountains, and in 157 days elapsed time the line was completed and in perfect working order.

Work Done by Ditching Machine on Per Cent. Curve and 4¼ Per Cent. Grade Near Newhall Tunnel in the Los Angeles Division.

The original agreements for the building of the line were entered into on November 26, 1911, and one of the conditions was that the construction work should be completed and the line ready for service, within 10 months after that date. Before any actual construction work could be begun, however, it was necessary to prospect a route. This meant several weeks of very hard work in the mountain section, as any number of possible routes presented themselves, and any one of them might appear to be feasible and practical until surveyed, when obstacles might be met with, which would condemn that possible route. In January, 1912, the preliminary and general survey of the most feasible and economical route was completed; and in the same month, orders were placed for 120 miles of 12¾-inch O.D. pipe, weighing 33 pounds per foot, and of which, two-thirds was of double length, plain end tubing, in 30 to 44 foot lengths; together with most of the detail specials.



Two Methods of Construction Over Washes.—Upper View Shows Castac Trestle on the Los Angeles Division, Built of Concrete Pipes and Steel Bents. Lower View is Structure Over Creek at Atmore, Showing Provision made for 14-Inch Line to be Laid Alongside Present 8-Inch Line.

The first carload of pipe was received, and ground broken on April 19, 1912, at the Los Angeles end of the line. The work was laid out in three divisions. Division No. 1 was at the southern end, and began at the Los Angeles terminal, extending to the beginning of the mountain division on the southern slope of the Coast Range. The second division was at the north end of the line in the Midway field, and extended in a southerly direction from the wells in the Buena Vista hills to the beginning of the mountain division on the north side of the range. The third, or middle division, comprised the mountain section of the route, and this was the principal portion of the line. Before a length of pipe could be laid in this section it was necessary to build 43 miles of road, over rough and steep mountain sides, in order to provide a way for the hauling of supplies to establish camps and land materials.

The work on the first and second divisions went along rapidly. At the Midway end the first carload of pipe was received May 1, and as the line went to the mountains by the shortest possible route, good time was made in trenching and laying the pipe over the flat plains.

In the middle division the undertaking was entirely different. The territory had to be pioneered, and brush had to be cut in order to establish camps, and a water supply provided in a country where water is a very scarce article. Two good springs were located, and 18 miles of water line laid to these sources of supply. In addition it was necessary to haul water to the pioneer camps, which were 22 and 30 miles still further distant. The hauling was first done by a "go-devil," or a 2-wheeled jump cart, drawn by mules, chosen because of their sure-footedness, over the mountain grades. As fast as the

Cast Saddle Rest at Trestle Bents, Showing Method of Coupling Line to Reinforced Concrete Pile Bridges Constructed Across Streams and Washes.

pipe line road was built, the "go-devils" were supplanted by 500 gallon tank wagons drawn by from 5 to 8 head of stock. The water cost 12½ cents per barrel for its purchase, and with the additional item of transportation it was a very expensive, although an absolutely essential part of the equipment.

The Two-Muled "Go-Devil" on the Left for the Transportation of Water; and the Private Telephone Line on the Right, Talking Over the Barbed Wire of a Rancher's Fence.

Upper View, Shows Pipe Crossing on Hangers at County Bridge No. 1, on the San Fernando Road on the Los Angeles Division. The Lower View Shows the Concrete Suspension Bridge Crossing at the Pacoima Wash on the Same Road.

The labor problem was one of the most serious, as the conditions under which the men were compelled to work were extremely bad.

In the middle division it was necessary to haul the men 57 miles from the nearest railroad station to the first camp. The difficulties may be realized to some extent when it is known that the payroll showed in excess of 11,700 different names in 5 months time, to keep a gang of about 700 men working on the 3 divisions. In numerous instances men were hauled to the first camp of the middle division, and after getting a view of the country, a sample of the heat, and the inconveniences of the camp life, they would stay just long enough for one meal, and then walk the 80 miles back to the nearest town.

Pulling Pipe into Place by Means of 4-Mule Teams in the Mountain District Over Especially Constructed Road.

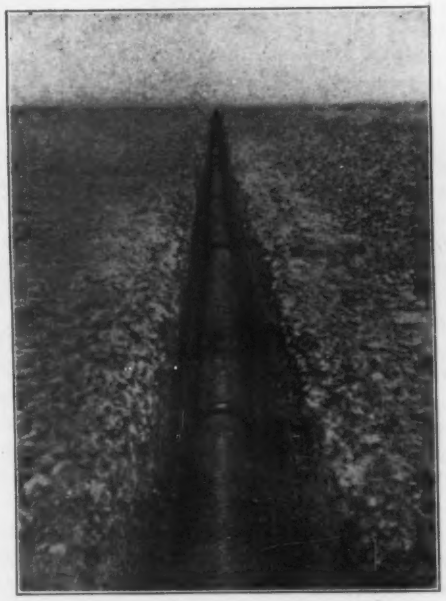
The hauling of materials and supplies was also a problem. In the north and south divisions, where the country was comparatively flat, and the double lengths of pipe were used, most of the hauling was done by motor trucks, with special trailers designed for the work. Where the roads were passable, a 5-ton truck and trailer could be loaded with from 20,000 to 23,000 pounds. In sections where the roads were rough these loads were reduced to 10,000 to 12,000 pounds. When the work reached the mountain district, where the line passes over an elevation at its highest point of 4,500 feet, it was necessary to abandon the trucks, and conduct the transportation with stock. This service was maintained in full operation with 1,200 heads, which covered all the line construction as well as maintaining the supplies in the camp.

Thirty Per Cent. Curve on the Main Highway Near Newhall Oil Fields.

The commissary was a very important matter as the line was constructed through a section of the country 30 to 50 miles to the nearest habitation. On the north end of the line, at the end of the San Joaquin valley, there where weeks at a time when the temperature ranged from 115° to 130° in the shade of a tent, and the water supply, which had to be hauled from 18 to 25 miles, was so strongly alkaline that it was necessary to ship into each camp of 100 men, 5 cases of lemons and 1 ton of ice per day, the lemons for the purpose of neutralizing the water and the ice for perserving the commissary supplies.

Seventeen camps were operated, distributed along the three divisions of the line. Each division was provided with a hospital tent and a doctor in charge, for emergency cases, and all of the hospital work was under the supervision of a general surgeon, who also had charge of sanitation. This section of the country is void of vegetation, except cactus and sage brush, but there is a generous supply of rattlesnakes, trap-door spiders, centipedes, tarantulas, and other inhabitants of the desert which, by the way, did not increase the peace of mind and comfort of the men on the job.

A number of special construction features were developed in the work, among which is a suspension bridge with concrete piers spanning the San Fernando wash. In other cases it was necessary to construct reinforced concrete pile bridges to carry the line over the Santa Clara river, and the San Francisquito wash. These bridges required 70 bents. It was not considered practicable to place the line beneath any of these streams on account of the extremely bad bottom, which, during the rainy season, is a movable mass of quicksand varying in depth from 6 to 15 feet. The piles are of the bell-bottom type, and jetted to a solid foundation, varying from 22 to 35 feet in length. They are capped with 8 inch "I" beams and the coupler rests in a heavy case steel saddle, bolted and strapped to the beam, allowing sufficient space, however, in the event of a leak, for the application of a bowl clamp.



The Big 12-Inch Gas Line as it was Laid for Miles and Miles Across the Desert in the Southern Part of Kern County.

Patrol stations are located every 10 or 12 miles along the route of line, each provided with the gauges for recording pressure, a supply of repair materials, and a private telephone line connecting with the main office at each end of the line, and each of the patrol stations. The patrolmen live with their families in cottages built by the Company. Under ordinary conditions the patrolmen make one-half of their district in the morning, meeting the patrolman from the next station at their terminal point, and the opposite half the district in the afternoon. The telephone line is provided with emergency jacks at each mile, and the patrolman carries a portable telephone set, so that, in the event of trouble, he would not at any time be more than half a mile from telephone communication.

When the work was tested out it developed one bad length of pipe, weld opened at 368 pounds, and three faulty couplings. When these repairs were completed, and a test was made from end to end at 170 pounds, the line proved bottle tight, and without a leak in the entire 112 miles. The pressure remained on the line for 5 hours without any drop in the gauges.

The designing, engineering and construction of the entire work were under the engineering and construction department of the J. G. White Engineering Corporation, of New York, and directly under the supervision of Resident Engineer W. E. Barrett, Superintendent of Construction H. M. Dougherty, and Assistant Superintendents Robert Brisbane, Frederick Weber and Ralph Cormack.

Gas Company Must Have Notice of Existing Leakage before It can be Held Liable for an Explosion.

In the case of Mowers *v.* Municipal Gas Company, of Albany (126 New York Supplement 1033), the Appellate Division of the New York Supreme Court held that a gas company is not liable for the damage done by an explosion of gas on private premises, where it has not had notice of the leakage and an opportunity to remedy the trouble.

The plaintiff was a tenant, in the basement of a house at 137 Broad street, in the city of Albany, N. Y. He brought this action against the Municipal Gas Company to recover damages for personal injuries resulting from an explosion. He had been in occupation of the premises on Broad street for about 10 months, and had noticed no particular odor of gas, when, suddenly, on the day of the accident, he discovered a strong odor and opened the windows of his apartment. Shortly after that the owner of the building entered another portion of the building and discovered the odor of gas. In looking about for its source, he came to the basement occupied by the plaintiff. Not finding any jets turned on, he went to the wall where the service pipe entered the building from the street. There was a dispute as to whether or not the landlord had a lighted match in his hand at the time; but, in any event, an explosion occurred at that moment, wrecking the room and injuring the plaintiff more or less severely.

It was subsequently found that there was a break in the gas main in the street, and that the gas had forced its way along the main and service pipe and into the house, and was pouring into the house in considerable volume. It was not claimed that the company was notified of the presence of gas in the house, between its discovery and the explosion.

The theory upon which it was sought to hold the defendant gas company was that the main in the street was old, and imbedded in wet, clay soil, favoring corrosion, and exposed to electric currents having a tendency to deteriorate the texture of the iron. It was contended that a break might reasonably be expected; and, further, that the break had existed for many months, the odor of gas being perceptible at various times, being quite strong on particular occasions. But the court held that the proof did not sustain this theory. There had been various complaints to the defendant company of the smell of gas by the occupants of the houses in the vicinity. Repair men were sent, the leaks in most cases being discovered and fixed, causing the odor of gas to disappear. In these instances the leaks were traceable to leakages in the pipes on the premises of the complaining parties, and were not due to a break in the main. It was manifest, from the testimony of various witnesses, that there was no such general odor of gas in the street as indicated a break in the main existing for months prior to the explosion, and the court held that such a situation was quite improbable. If the break had existed for months, as claimed by the plaintiff, the odor would have been continuous, especially during the summer months when the surface of the ground was not sealed by frost. There was no proof that the company had had notice of the break in its pipe, or that the condition of the pipe was such that the company should have known of it. The company was, therefore, not liable for the injuries to the plaintiff.

The general rule is that, in order to render a gas company liable for damage caused by the leakage of gas on private premises, the company must have notice of the leak and a reasonable opportunity to make repairs. This rule was followed in the earlier New York case of Hammerschmidt *v.* Municipal Gas Company, 114 N. Y. App. Div., 290; 99 N. Y. Supp., 890. It was held then that a gas company is not liable for injuries caused by a leakage in its gas main from which gas, confined by the frozen ground above, permeated through the soil into the plaintiff's premises, when no complaint was made to the company, and there were no surface indications of the leak discoverable by inspection.

The reason for the rule is that a gas company is not liable for damages in connection with a leakage of its gas until it is shown to have been negligent. If it has no notice of a particular leak and, therefore, no opportunity of fixing the leak, it is not negligent and so cannot be held liable for damages.

There are, of course, cases wherein gas companies have been held liable for injuries resulting from an escape of gas, although the company had no actual notice of the leakage. These cases are based on the ground that a gas company is bound to maintain a reasonable inspection of its lines for the purpose of preventing accidents that may occur by reason of the escape of gas. This does not mean that the company is under an absolute duty to prevent all accidents; but, rather that, if a certain accident might have been prevented by the exercise of a reasonable amount of care on the part of the company in inspecting its lines, the company may be held liable for the accident although it had no actual notice of the leak. In other words, the company is presumed to have had notice and is held negligent for not discovering and repairing the break in its pipes. The gas company's duty of inspection was discussed in an article published in the JOURNAL, issue for July 31, 1911.

Gas Engines Cooled by Internal Injection of Water.

By PROF. BERTRAM HOPKINSON, F.R.S.

At a meeting of the British Institution of Mechanical Engineers, held in Cambridge last month, Prof. Hopkinson's contribution to the proceedings was an excellent recital of what the author terms "A New Method of Cooling Gas Engines." He remarked that perhaps 30 per cent. of the heating value of the fuel used by a gas engine passed into the metal of the cylinder. Hitherto such heat was removed by water cooling, which practice was the final cause of many of the disadvantages under which gas engine labored, and which was responsible for the tardiness of development in the larger sizes of such types of engines. In order that the heat should flow from the inner surface of the metal, where it entered, to the outer surface, where it was removed, there must be a difference of temperature between these surfaces proportionate to the thickness. The necessary thickness was 50° C. per inch, and, while not of much moment in small engines, it becomes serious in large sizes, where the cylinder walls were 3 inches thick or more. In consequence of the dangers of overheating, it had been found impossible to work large size gas engines continuously at the maximum power which they could develop; and, in order to obtain at all satisfactory results, it was necessary to use weak mixtures, and even at that trouble was apt to arise. If it were possible to allow large gas engines to work continuously at the maximum power they were capable of developing, the cost per horse power would be reduced by from 20 to 40 per cent.

It seemed obvious that these difficulties could be overcome by applying the cooling medium on the inside of the cylinder instead of to the outer surface, for if water could be injected internally against the surface to be cooled, there was no heat flow through the metal, hence no difference of temperature between the inner and outer surfaces. Thus the engine could be maintained at substantially the same temperature all over, and the stresses due to unequal heating might be eliminated. The idea of introducing water into an internal combustion engine was not new. It had not, however, been a practical success because the originators did not appreciate the conditions which must be satisfied. Of these the most important was that the water must be projected in comparatively coarse drops or jets, directly against the surfaces to be cooled, so that it reached these surfaces in liquid form. Further, it must be distributed so that each portion of the metal receives water in the proportion in which it received heat. It was of no use to inject the water in a fine spray, or to introduce it into the gas or air pipe, so that it was carried in suspended in the incoming charge or (as was often done in oil engines) to spray it in with the oil. Though some of these devices had proved useful for preventing pre-ignition, and for the softening of the explosion, none of them was effective for cooling. For that purpose it was necessary to project the water positively and directly against the metal surfaces.

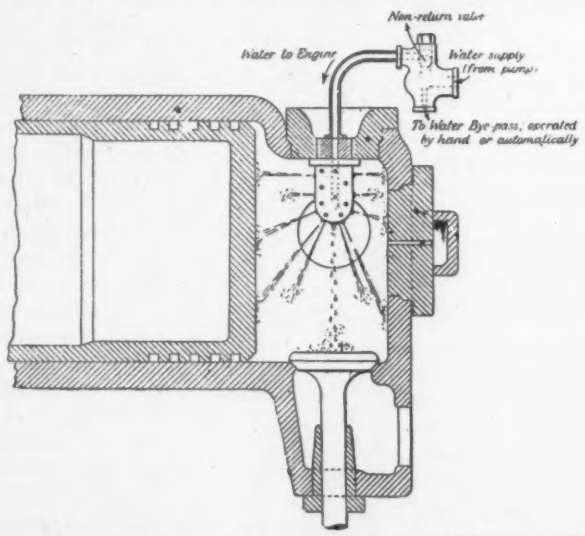
When the author began to consider internal injection for cooling, difficulties of corrosion and lubrication seemed to be insuperable until it occurred to him that they could probably be overcome by regulating the amount of water injected, so that the temperature of the engine was kept well above 100° C. Under such conditions every drop of injected water was boiled when it reached the walls, and no liquid could accumulate. The large drops of water projected from the nozzles could dissolve but little gas on their way to the walls, and what little they did absorb was at once driven off when they struck the hot metal, the water being converted into steam.

It was known, from the experiments of Mr. Dugald Clerk, the author, and others, that the rate of heat flow from the gas into the metal was far more rapid at, and soon after, the moment of ignition than at any other time. It seemed likely from these experiments that, for practical purposes, the heat-flow into the barrel of the cylinder during the last three-fourths of the expansion stroke might be so small, compared with that in the first period, that direct cooling of this portion of the cylinder could be dispensed with altogether.

This anticipation had been found correct. It was sufficient to inject water on to the surface of the combustion chamber and the head of the piston only, the whole of the cooling of the barrel being effected by conduction into the piston, which was itself kept cool by the projection of water on to the head when it was near the in-center. The application of water was thus confined to places where it could do no harm, none falling on the sliding surfaces. The absence of pre-ignition under such conditions was also noteworthy, and showed the efficiency of the cooling.

In order to put these ideas to a practical test, a Crossley engine, 11½ inches diameter by 21 inches stroke, rated at 40-brake horse power at 180 revolutions per minute, was fitted with a cylinder consisting of a plain barrel without any water jacket.

A section of the new cylinder with water injection rose is shown.



The rose projects into the combustion chamber, and has some 25 holes in it, each $\frac{1}{16}$-inch in diameter, and the jets are directed against all parts of the combustion chamber and piston head.

The water is injected by a simple plunger pump, driven by a cam on the valve shaft, whereby a charge of water is injected once in a cycle. The pump stroke commences about 30° before and finishes about 30° after the point of ignition, so that water goes in when practically the whole of the sliding surface of the barrel is covered by the piston.

With the new cylinder, the engine was run continuously for 120 hours, on an electrical load, with coal gas. Continuous observation was kept of the gas consumption and of the load.

The engine developed 43-brake horse power on the average, and ran very smoothly and steadily. The average mean effective pressure was 101 pounds per square inch. When jacketed, the engine would not develop more than 40 brake horse power continuously without overheating, and mixtures giving a mean pressure of more than 100 pounds per square inch produced excessive maximum pressures (over 500 pounds), with violent explosions. The reduction in maximum pressure by water injection was over 100 pounds per square inch, being very marked, the explosion being almost inaudible. This effect of steam in the explosive charge is well known, but the quantity of steam formed in an engine cooled in this manner is so large that it constitutes a substantial advantage. The formation of the steam does not involve any thermodynamic loss, such as occurs when water is sprayed into the cylinder and evaporated before reaching the walls, since the heat used is that which would otherwise be wasted in the jacket water.

The quantity of water used on this trial was, on the average, 102 pounds per hour, equivalent to 2.4 pounds per brake horse power hour. The temperature of the engine varied from 150° to 180° C. No water was visible on the piston or the spindles of the valves, and when the engine was stopped at the end of the trial the inside of the combustion chamber was perfectly dry. When the engine was jacketed, the jacket water removed about 67,000 B.T.U. per hour, which would be sufficient to evaporate 108 pounds of water at a temperature of 20° C. under atmospheric pressure. The agreement between the available heat and amount of water evaporated is satisfactory, such difference as there is being accounted for partly by greater radiation loss consequent on the higher temperature of the engine, and partly by the reduction in flame temperature produced by the steam, which somewhat reduces the total amount of heat passing into the walls. The engine consumed in this trial 15 cubic feet of gas per brake horse power hour, reckoned at atmospheric temperature and pressure. This is approximately the same as it burned when developing the same power for short periods when jacketed. Tests at other loads show that, with a weak mixture, the gas consumption is slightly increased by the water injection, but with very strong mixtures it is a trifle less; and, on the average, it may be said that the economy is unaffected by this method of cooling.

After the trial described, the engine was put to drive a dynamo in a factory engine room. Its speed was increased from 180 to 195 revolutions per minute, and for several weeks was worked continuously for long periods of time at excessive loads. It developed at times 50-brake horse power for several hours together—20 per cent. more than it could safely carry when jacketed. The engine is now in regular service, with a suction producer, driving the workshops and producing electric current for the engineering laboratory, and have been in regular work for two years.

From the nature of this method of cooling it seemed certain that its effectiveness would be independent of the size of the engine. Each foot of metal receives a certain amount of heat from the gas, and it is only necessary to deliver to the surface as much water as would be evaporated by the heat which it received. This has been proved by applying the method to an engine of 18½ inches bore, giving 105-brake horse power, and a 1,000-horse power Oechelhauser engine of 36 inches bore. In each case the water was simply run out of the jackets, the injection rose fitted, and the engine put again to work. These trials proved that the largest cylinders now built could be cooled entirely by water injection. They also showed, however, that, for ordinary commercial use, the cylinder must be properly designed with a view to the employment of this method of cooling. In fact, the experiment of running a 1,000-horse power jacketed cylinder, without any water in the jackets, did not prove to be the best way of developing the idea commercially and in detail. It was, however, an interesting and striking experiment, and showed the great capacity of the method of internal injection. The whole injection apparatus was made and put together in Cambridge; it cost about $100, and within a few hours of fitting it on the engine it was doing all the work of the cooling tower, centrifugal pumps, 8-inch water mains, and the like—which were necessary for the cooling service of an engine of this size when jacketed.

Some Home Experiments in Illumination from Large Area Light Sources.

[From a paper by Mr. Herbert E. Ives, Illuminating Engineering Society, Philadelphia Section.]

It was in an effort to light my own home satisfactorily that the experiments described were begun, and the matter is somewhat rambling, and the experiments incomplete, but as the next stage of the work may be delayed it was thought well to publish this much.

A great advantage of using one's own house as an illumination laboratory is, one can live with the lighting system and learn how it wears, and the rooms have their furniture in place. To attempt to judge a lighting scheme in a bare laboratory room is too serious a handicap, and a considerable disadvantage is that it is difficult to make changes in the positions of the outlets. This limits experimentation, consequently some of the things described in this paper are incomplete, and it must end with suggestions as to what might be better.

A characteristic of home lighting is that efficiency counts for little. Furniture and pictures are not bought for their cheapness; neither should light be. In domestic lighting the real problem is to obtain a pleasant illuminative effect, without regard to cost. In these experiments no attention has been paid to efficiency. Many possible lighting schemes have not been tried at all—notably copies of daylight distribution—because the illuminating engineer has been apt to think too quickly of efficiency. He should first obtain the desired effect, then count the cost. Even if it costs too much now, we must look forward to the day of more efficient light sources, and we may bring that day nearer by finding greater needs for them.

This paper is to be comparatively free from foot-candle values, watts per square foot, and the like. The points aimed at are diffusion, proper direction, freedom from excessive contrast and glare, pleasant, non fatiguing quality, and good appearance. How can these be measured? In the writer's opinion the only reliable and sensitive instrument is the experienced eye. How sensitive we have become to exposed light sources. Formerly they irritated us; but

we did not know the cause. Now we choose our position with care, shield our eyes, and in other ways give testimony to the vastly increased sensitiveness of our seeing mechanism. We have generally available no method of measuring lighting conditions which will do more than distinguish between two so extreme in quality that a mere casual glance will tell which is good and which is bad, and, until we are better off in this respect, the trained eye must be encouraged as the best we have. It is useless to measure factors that are not the ones really vital. If home illumination demands diffusion and a feeling of comfort, meter-candles illumination on the working plane has very little to do with the problem. Measurements are of no value unless they record conditions the qualities of which are proved by experience. This paper deals with lighting schemes whose measuring instrument at present is experience, and I give here, as the final criticism, my own judgment of the success of an installation. In all cases, however, I have had as many comments and suggestions from others as I could obtain.

One peculiarity of daylight illumination from windows is its direction. Most artificial systems cast the light downward from a point near the center of the ceiling. There then occurs in changing from day to artificial light, a 90° rotation of shadows. By day they are long and sweep across the room; by night they are short, or completely covered by the shadow-casting object. Sidewall brackets, floor standards, or table lamps on side tables, approximate more nearly to window conditions.

Diffusion of light with soft shadows is best brought about by a large area of light source, and is one of the merits of the "indirect" system. A certain degree of diffusion can be obtained by a multiplicity of light sources, although this is apt to give merely a multiplicity of shadows, instead of the soft shadow of the large source. The ordinary window (5 or 6 square feet) gives a better degree of diffusion than most artificial schemes. Another factor in diffusion is color. Blue light diffuses better than yellow, and, therefore, daylight is apt to be better diffused than is yellow artificial light.

In regard to contrast and glare, it is well to bear in mind some numerical data. A Welsbach mantle has an intrinsic brilliancy of .35-candle power per square inch; a tungsten filament about 1,000, and a patch of sky about 2 or 3. For the same intensity of illumination—that is, the same general brightness of illuminated objects—therefore, the physical contrast between the brightness of the illuminated objects and the light sources themselves will be from 10 times to hundreds of times greater with visible "direct" artificial light than with daylight. If the light sources are concealed, this contrast is avoided, but it occurs again if specularly reflecting surfaces are present. These reflect images of the light sources with about 1/10 or 1/20 of the intrinsic brightness of the source. It is immediately evident to an expert whether the lighting of a room is due to small or large sources, by an inspection of these two things, the sharpness of the shadows and the brightness of the specular reflections. Half of this handicap of small sources is eliminated by avoiding specularly reflecting surfaces.

Out-of-doors daylight may be pleasant or unpleasant. In a previous paper, which records brightness measurements of typical outside illuminations, certain conditions were found to be most pleasing. These were, an excess of brightness in the upper hemisphere, usually with a maximum near the horizon; and (a very essential condition) sunlight directed from the side, to give long shadows.

A criticism of many "indirect" installations is that the "brightness" furnished by the light ceiling is bounded by dark walls carried up above the eye line. This gives the effect of being down in a well, or as though the room had been lifted up away from you. To produce a real, out-of-doors daylight distribution calls for an extension of this brightness down to the horizontal. The wearing of hats must be taken into account, protecting the eyes from overhead bright areas, and reducing the vertical component of the illumination on the face.

The effect of the large sky angle on the extreme brightness ratio must not be overlooked. Out-of-doors the sky approximates an infinite plane. Under this a white surface will be as bright as the illuminant, while other objects will be bright in proportion to their reflecting powers. As the area of "sky" is decreased its brightness remains the same, but that of illuminated objects becomes less, thereby increasing the extreme brightness ratio between the unconcealed illuminant and illuminated objects. Diffusion is also decreased, and shadows take on a more definite downward direction.

In Fig. 1 the idea was to carry the direct illumination of an indirect system down on to the walls, to approximate out-of-doors conditions,

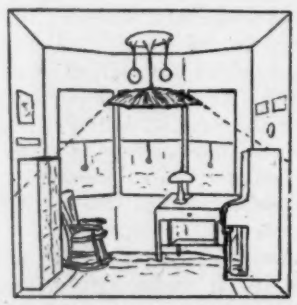


Fig. 1.—Diffused Illumination from Side Walls.

and thereby produce a pleasant diffused illumination. The room was 14 feet square, furnished with a central fixture, and papered a medium light buff. Under the fixture was a yellowish Japanese umbrella of oiled paper, convex side up. The direct light of the lamps thus fell on the walls, which acted as the chief light source of the room, since the transmission of the umbrella was low, the ceiling little brighter than the walls, and largely invisible because of the size of the room. A peculiar merit of this scheme is the splendid illumination of the pictures on the walls. These had to be slightly tilted to prevent reflection of the bright light sources, and in the direction of the entrance doorway a translucent Japanese fan was placed above the umbrella to conceal the lights. This installation was used for months and gave great satisfaction. There was no tendency for the eye to wander upward to a bright point above. Although the illumination seemed low, it proved ample for sewing and other close work, without the fatigue customary to working with "artificial" light. A pleasing addition to the general diffused lighting was furnished by a table lamp on one side, copying the direct light of the sun. One point proved by this experiment is that light walls, well illuminated, help in a marked degree the general effect of brightness. A room looks brighter with bright walls, and, unless some extreme case is taken, this means that the object—to light the room—has been attained.

This lighting arrangement is suitable for a small room, or with a large room, a number of ceiling outlets not far from the walls. In indirect or semi-indirect installations it might be of interest to tilt the units near the walls, in order to secure a similar effect. The units might be made purposely unsymmetrical.

The classification, direct, indirect and semi-indirect, while convenient, is by no means a complete analysis. The true basis of classification is the size of the light source, and whether it is concealed or visible. The gas flame and the carbon filament were small sources of relatively high intrinsic brilliancy. From them we are working toward large light sources of lower intrinsic brilliancy. The fact that some of these are large areas of diffusely reflecting ceiling, and that others are large areas of diffusely transmitting glassware, is of no great significance. It is of significance that the light source is of large extent, and low intrinsic brilliancy. It is also of significance that in these cases (indirect and semi-direct) the principal light source is visible. By "principal light source" I mean the source which furnishes the greater part of the light which falls on floor, furniture and working plane. It is also of great importance that, as ordinarily worked out, in indirect and semi-indirect installation, the light source is of necessity the brightest object in the field of view. Therefore, these systems sift down to this: That the unconcealed light source is made as large as is possible, to make its intrinsic brilliancy low and bearable. Incidentally this gives great diffusion of light and soft shadows. In some forms of direct lighting partial or complete concealment of the light source is employed. In this case the principal light source may not be the brightest object in the field of view. If the concealment is sufficient there may be a complete absence of points of high intrinsic brilliancy—more so than in the indirect system—except for points of specular reflection of the light sources, if polished surfaces are present. These latter are of high intrinsic brilliancy in the direct systems and low in the indirect. While we have lighting systems with large, visible, low-brightness sources, and systems with small, either visible or unvisible, high brightness sources, there are none consisting of large, low brightness concealed light sources which is the specification of pleasant daylight illumination from windows.

The characteristics of indirect lighting can be obtained without reflection, if a large enough, low-brilliancy source is used. This was experimentally accomplished by a yellowish-oiled paper, Japanese umbrella, 4 feet diameter, turned point down, within which are the lights in frosted globes. (Fig. 2.) Some light falls on the ceiling,

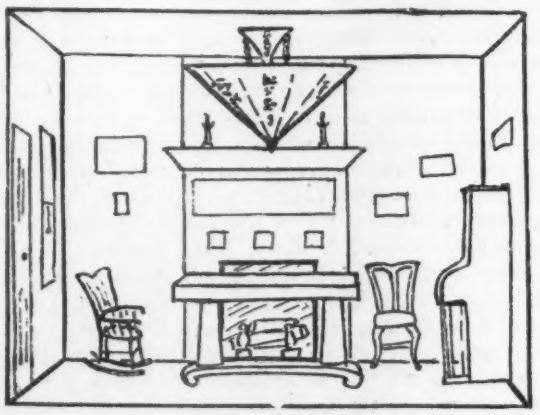


Fig. 2.—Illumination from Large Area, Low Brightness Overhead Source.

so that it might be called semi-indirect, but most of the illumination is due to the visible light source. This is of rather low intrinsic brilliancy, so that it can be looked at without strain. and gives ample light all over the 16 foot by 20 foot room, with an emission of about 7,500 lumens.

Because of the size and low intrinsic brilliancy, shadows are soft and specular reflections are too dull to be annoying; and the conical shape gives a better illumination of the walls and far corners than would be possible by a ceiling reflection scheme. On the other hand, the direction of the shadows for the center of the room is straight down and, therefore, different from the most agreeable daylight condition. But the greatest defect is that the principal light source is visible, and, low as is the intrinsic brightness, it is the brightest object visible, and is too bright to be continuously in the field of vision. When the occupants sit around the center table, or sit sideways to the light, the illumination is extremely satisfactory. If, however, they face each other across the center, the large, bright, umbrella becomes an irritant—far less, of course, than would the usual bright points, but still noticeable to a sensitive and critical eye.

The experiment was tried with a still larger light source, but it had the same defects. The conclusion was that, increasing the size of the source, unless it actually occupied the whole upper hemisphere—which is out-of-doors daylight on a sunless day—would not make the light source innocuous. Diffusion alone is not sufficient. Any system in which the light source is the brightest visible thing gives an extreme brightness ratio too great to wear well. If in the room illuminated with the large umbrella, the hand is held over the eyes, or an eye shade is worn, it leaves little to be desired; only the direction of the light can be objected to; and some might prefer the centrally located source. The higher the light source the less is this defect, so that the indirect practise of making the ceiling the real source, chooses the best condition. For it then approximates at a concealed source in a small room.

Window lighting may be insufficient, or it may cause excessive contrast in brightness. In my house the living room has one door and one window on the front with two windows at the side facing another house. Ordinarily the room is not sufficiently lighted by daylight, the front window being too narrow. If the shade is run up to the top it is impossible to look with comfort at the window, because the large patch of bright sky visible, is in violent contrast with the unilluminated wall at the sides of the window. Even with the shades down the houses opposite are apt to present too great contrast of brightness with the walls adjacent to the window. Under only one condition is the daylight really satisfactory, and that is when a spot of sunlight falls well back on the floor, the houses opposite being in the shade. Then the walls adjacent to the window receive light from the floor, the ceiling receives light from the floor and from the pavement outside, and all is bright and cheerful. With snow on the ground the effect is still better. Another example of bad daylight illumination is the upper floors of a tall office building, not faced by any other structure. If one sits facing a window, one sees a large expanse of bright sky, which soon becomes painful, and the occupant places his desk so that his back is toward the windows. In my house I have an instance of a pleasant and satisfactory daylight illumination. It is a second floor room, facing south, with two adjacent windows in a bay nearly the width of the room. The wall paper is a figured gray of approximately 45 per cent. reflection coefficient. (Fig. 3.) Such a room is hard to illuminate satisfactorily by daylight or artificial daylight because of its depth.

Observations made in this room, revealed some interesting points.

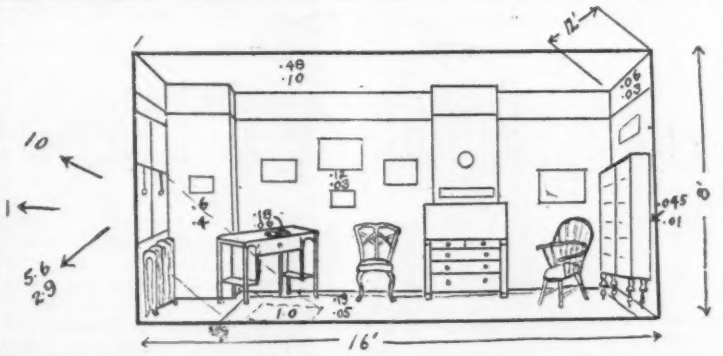


Fig. 3.—Distribution of Surface Brightness in Arbitrary Units by Daylight. Large Values, where Sunlight Falls on Floor. Small Values, Sun not Streaming in.

(1) At all times, raising the shades above the middle sashes made the lighting less pleasant. (2) The room was brightest and most pleasing when the sun streamed in on the floor or wall and shone on the street below. (3) The effect was unpleasant when the sun fell upon the (gray stone) house fronts opposite. (4) A gray or misty day was not pleasant. (5) The distribution of illumination was such that the face of a person sitting with his back or side to the window received sufficient light from the room so as not to be in marked contrast to the background, or to have the two sides of his face unduly different in brightness.

Two sets of measurements of brightness are shown in Fig. 3, one with sunlight streaming in the window, the other when it is on the street below, but not streaming in nor on the houses opposite. Both effects were extremely satisfactory.

The most pleasant conditions are those when the effective light source is of three parts: (1) A large area of bright sky subtending the solid angle of the window, invisible from the greater part of the room and illuminating the floor and lower part of the room. (2) A large area of intrinsic brilliancy abous one-tenth that of the sky, visible from the room (houses opposite). (3) A large area of intrinsic brilliancy about $\frac{1}{4}$ to $\frac{1}{3}$ that of the sky, invisible from the greater part of the room, but illuminating its ceiling. Remember that these light sources are at the side, and that the bright sky is of much lower intrinsic brilliancy than most artificial light sources, and the complete specification of pleasant window daylight of that room becomes something like this: Illumination from large area concealed light sources at the side; and that is just what is absent from prevalent lighting systems. We must add to these conditions the further one that the walls adjacent to the window must be well lighted in order to prevent excessive contrast. This is frequently accomplished by having windows on two sides. In the present case the walls adjacent to the windows are perpendicular to them and are, therefore, lighted by the one set of windows.

It is interesting in the light of these observations to notice that low, broad windows are common in the newer houses, taking the place of the old-fashioned, high, narrow windows, the upper portion of which sometimes cannot be used without exposing to view a dazzling patch of sky.

This makes possible a study of these windows as a light source. As viewed from a point in the room the windows present the appearance of two adjacent squares, 30 inches by 30 inches, with their centers at a height of 42 inches above the floor. As viewed from various points the angle subtended by the light source changes, diminishing to zero above and below and to either side. Were the landscape seen through the window of uniform intrinsic brilliancy, the window would be equivalent to a flat, uniformly bright, plate of thick opal glass illuminated from outside, or a diffusely reflecting surface, such as an "indirect" ceiling source turned through 90°.

In this room the change of intrinsic brilliancy and effective area can be followed by Fig. 4, in which the window is considered as a point source of light. Starting directly below the window the illumination is from a narrow slit of the intrinsic brilliancy of the sky. As the test surface is moved away from the window this slit increases in width (as the cosine of the angle with the normal) until a point *A*, well back on the floor, is reached. Here the tops of the houses opposite become visible, cutting off part of the sky. At the point *B* the sky is no longer visible, and from there to the point *C* the intrinsic brilliancy of the window is that of the house opposite. Between *C* and *D* the street below becomes visible, and from *D* on the ceiling to the window, the illumination is from a patch of the brightness of the street surface. There are, therefore, in this case three different

(*Continued on page* 138.)

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A. M. CALLENDER, Vice-President and Treasurer.
CHARLES H. WADELTON, Secretary and Manager.

THOMAS J. CUNNINGHAM, SANFORD K. CAMPBELL, } Editors.

NEW YORK, MONDAY, SEPTEMBER 1, 1913.

[Official Notice.]

Annual Meeting, Michigan Gas Association.

Michigan Gas Association,
Office of Secretary,
Grand Rapids, August 12, 1913.

To the Members, Michigan Gas Association: Did you ever hear Mr. Herbert N. Casson talk to the gas men? Did you ever hear him talk to anyone? Well; there is a great treat in store for you at the next meeting of our Association, for he will then talk to us on the subject of "How to Get Gas Across." Mr. Casson is great. He makes you laugh, cry, "sit up and take notice," and applaud his forcible, entertaining arguments, with his original ideas of modern business building. Then, too, we will have some mighty good papers, as witness:

"Practical Effects of the Workmen's Compensation Law," by Mr. Albert G. Schroeder.
"Gas Advertising," by Mr. Alonzo P. Ewing.
"The Increased Cost of Gas Making Materials," by Mr. B. O. Tippy.
"Educating the Public," by Mr. Ernest F. Lloyd.

Among other things our entertainment programme will include an afternoon boat trip and supper at Bois Blanc. On the boat we will have another good talk by a very prominent newspaper man, who will tell us some things that we all ought to know. A meeting in Detroit always brings out a big crowd, and this promises to be one of the big meetings.

The city, Detroit; the place, Hotel Pontchartrain; the time, September 17, 18 and 19th. Make your hotel reservations now.

Yours very truly, Glenn R. Chamberlain, Secy. and Treas.

[Official Notice.]

Time and Place of Next Meeting, Iowa Gas Association.

Iowa District Gas Association,
Office of Secretary,
Des Moines, Ia., Aug, 22, 1913.

To the Members, Iowa District Gas Association—Gentlemen: The Council of the Iowa District Gas Association has decided to hold the next annual meeting in Davenport, Ia., on May 27th, 28th and 29th, 1914.

Yours very truly,
G. I. Vincent, Sec.-Treas.

[Special Editorial Correspondence, by Telegraph.]

THE 1913 SESSION OF THE CANADIAN GAS ASSOCIATION.

Engineers' Club, Toronto, Ont.,
August 28, 1913.

Just a little trifle showery, but beautiful Toronto (which is packed to the limit with the farmer-folk who are attending the Fair at the great grounds of the Canadian National Exhibition Corporation) looks fine, despite the drip. The attendance is excellent, over 4 score showing on the register. That prince of Canadian gas men (Mr. Arthur Hewitt) and his right-hand Secretary member (whole-souled John Keillor) did as they always do; kept things going with a vim, and in this accelerating they had the undivided, direct assistance of each member. The Hewitt inaugural was a plain rehearsing of conditions existing to-day in the artificial lighting industry of Canada. The paper list was a surprise to everyone, and it certainly bristled with numbers that had in their chapters plenty of provocative for discussion. The morning was given over to the papers, and following the first adjournment, an excellent luncheon was served in the Club dining room. The afternoon was of a "mixed sort." Some visited the splendid modern plant of the Toronto Consumers Gas Company, while others visited the Fair Grounds, there to inspect the splendid exhibition of gas appliances, well set up in the Gas Building. In the evening the delegates and guests occupied special seats in a reserved section of the great outdoor auditorium, there to witness the spectacular fireworks exhibition, "The Burning of Rome." The officers elected were: President, Mr. A. A. Dion, Ottawa; Vice-Presidents, Messrs. Howard Mann (our own Howard) and R. A. Wallace; Treasurer-Secretary, John Keillor; Executive Committee, Arthur Hewitt, J. P. King, J. M. H. Young, S. Carter and J. S. Norris. As you will go to press prior to the noon adjournment to-morrow (the 29th), you will have to mark this "To be finished in our next."—Camp.

BRIEFLY TOLD.

The Annual Meeting of the American Gas Institute.—The Richmond, Va., meeting (October 15 to 18) convenes under somewhat peculiar circumstances, as that city is served by a municipal plant. Notwithstanding this novelty, the welcome is more cordial and pronounced than customary, the press and the public taking exceptional interest in the matter. This is quite clearly shown by the fact that the city, through its Chamber of Commerce, has tendered the Institute a reception, which promises to be an enjoyable affair, and in fact, will likely be one of the features of the meeting. The Jefferson (headquarters) is unusually well equipped for such a convention, and, with the list of papers to be presented (and the lecture as well), it bids fair to exceed in interest and pleasure any former meeting of the Institute. No other city in the country has greater historical interest, and no other city contains more evidence of its activity in the early formation and continuous growth of the country.

"Educating the Public in the Use of Light."—Within the past month the Illuminating Engineering Society has printed, for several large lighting and manufacturing companies throughout the country, an edition of more than one-quarter million copies of its illumination primer on "Light: Its Use and Misuse." This little publication, which has been referred to several times in the Journal, presents in brief and popular form the principles of good illumination. It is being widely circulated by these companies for the purpose of creating an appreciation and demand for more and better light. The Consolidated Gas Company of New York has issued 100,000 to its customers; the New York Edison Company, 50,000; the Edison Electric Illuminating Company, of Boston, 26,000; the Philadelphia Electric Company, 10,000; and the Commonwealth Edison Company, of Chicago, a like number. Several other companies have sent out editions of from 2,000 to 10,000 copies. In a way, this large distribution of the primer constitutes an educational and business campaign which is both interesting and unique. The recent edition of the primer, which contains a few minor changes in the original one, was published in a very inexpensive form so that it might be circulated widely at a small cost. For the companies proposing to issue this pamphlet to their customers during the coming busy lighting season the Society is arranging to publish two new large editions, which will be available at prices that scarcely cover the publication costs involved. Sample copies may be obtained by interested companies upon application to the general offices of the Society, 29 West 39th street, New York.

Digest of Circular Number 32, Second Edition.—We are indebted to the attention of Dr. E. B. Rosa, Acting Director of the Bureau of Standards, Department of Commerce (Washington, D. C.), for an advance copy of this Circular, which has to do with "Standard Regulations for Manufactured Gas and Gas Service." The introduction and the first section, under Part 1, "Discussion of Technical Specifications," summarize briefly the attitude taken by the Bureau on the subject of desirable specifications for gas service. Section A, on "Candle Power and Heating Value," discusses the relative value of these two properties of gas as a basis for a quality requirement. The discussion is more detailed than in the former edition of Circular 32; and the recommendation of the heating value as a major requirement is made even more emphatic, the retention of candle power values as a secondary standard being urged. Under "Net and Total Heating Value Standards," is given a discussion of the merits of the "net"

and "total" heating values of the gas as standards of specifications. The conclusion is in favor of the total. Possibly the most important changes which have been made in the circular, and certainly those which have caused the most comment, are discussed under "Heating Value Required," on page 25. The first important point considered is that of rating the heating value of a gas on the basis of the heat which it actually retains on the average when delivered. This is to be done by correcting the observed volume of the gas burned in making a heating value determination, to the annual average pressure of the gas in the city in which the test is made, instead of making the customary correction to 30 inches of mercury pressure. The advantages of each method of rating are set forth. The former method is favored for general use; but the second method is still so much used that it was thought best to include alternate forms in the model ordinance, in case this method of rating was desired. Under the headings, "Relation of Price and Quality of Gas" and "Heating Values Required," it is pointed out that the quality of gas distributed should be so regulated that the maximum amount of heat will be furnished to the customer for each dollar of cost to him, and that the price of gas should be so adjusted in each case that the gas company will receive a fair profit when distributing gas of the quality specified. A summary of the recommendations in regard to heating value is given on page 33. Under the title "Significance of Gas Candle Power," beginning on page 35, is a discussion of the testing methods and standards in use, the effect of atmospheric conditions, etc. Under "Candle Power Required," it is pointed out that any candle power requirement should be made secondary to the heating value requirement; and that it is frequently undesirable, from an economic standpoint, to maintain such candle power as now required in many places. A new basis of rating photometric standards is recommended, in order to bring various flame and electric standards into agreement at different altitudes, and to give each the actual value suited to the local conditions. In respect of "Chemical Requirements," no change of importance is made from the former edition of the circular, and none recommended from common practice. In the discussion of gas pressure limits (page 52) it is pointed out that, within certain limits, it is of no great importance what pressure is maintained, provided the pressure is sufficiently uniform; and the highly sensible suggestion is made that the pressure to be maintained in different districts of a city should be left to the judgment of a company's engineers. A new form of regulation, permitting companies to select the normal pressure to be maintained in each district of the city, is proposed (Section 10 of Model Ordinance). In the section on meter testing, "Accuracy and Testing Required" (page 60), it is recommended that all meters be adjusted to an accuracy of 1 per cent. before being put into service, but that the company should not be required to make refund when a meter which has been in service shows an inaccuracy of not more than 3 per cent. Part 2, on "The Enforcement of Technical Regulations," contains an extended discussion of the relative desirability of State and city control of technical gas requirements, and the best means of exercising that control. The model gas ordinance and State rules recommended (Part 3, page 97), are so framed as to summarize all the recommendations made in Part 1. Several alternate forms are provided, in order to permit the ordinance to be adapted to a large variety of conditions. The summary of the existing State and city laws, the brief description of the methods employed in the manufacture and distribution of gas, and the tables given in the appendix are set forth as general information for those not familiar with the technical points in the subjects described, and as data for reference.

OBITUARY NOTE, CAPTAIN JONATHAN D. CATHELL.—"The veteran members of the fraternity will learn with regret that Capt. Jonathan D. Cathell has gone beyond; but such regret will be softened in the knowledge that the veteran's days were far in excess of those allotted by nature to man. Born in Sussex, Del., September 24, 1817, he had almost attained his 96th year, the summons having been heard by him the evening of August 19th. His early life was marked by the struggles which attend those who are obliged to make headway for themselves at youthful age; and it was with slender stock of regular tuition that he engaged in his life's work. In 1834 he indentured himself to the captain of a trading vessel, and made many coastwise trips, subsequently crossing the Atlantic several times. In 1841 he sailed from the St. Johns river, Florida, for Washington, D. C., in command of the "Climax," of which vessel he was also owner. The vessel was lumber laden, and the cargo was disposed of to the father of the man who subsequently became known as Governor Shepherd, of the District of Columbia. He next (1844) became connected with a combination of shipowners, managed by the then world famous firms of F. & A. H. Dodge (Washington), and Sturgis, Clearman & Co., of New York. This combination did much work on government account. In 1852 deceased gave up all connection with seafaring matters, and formed an express partnership, transacting local business in the District. In 1854 Mr. Cathell was appointed Superintendent of the Georgetown Gas Light Company, in which position he continued until 1892, when, at the age of 75, he was pensioned in the sum of $1,000 per annum. His activities in connection with the Georgetown Company were of the careful sort, and under his management it grew, from a puny, struggling corporation, to a concern of magnitude and of strong financial standing. The funeral services were held in the Congress Street Methodist Church, Georgetown, the afternnoon of August 21st, and prominent in the mourning delegations that attended the ceremonies was a representation from Covenant Lodge, I.O.O.F., of which body deceased was the oldest member, both in years and in continuous membership. In fact, his membership dated from 1845, two years after the instituting of the Lodge. A remarkable thing in respect of deceased was his wonderful freedom from illness, and the retention of his faculties to the very end. His failing from actual sturdy vitality dated back only a week prior to his death. His wife (who is also really a remarkable example of sturdy vitality) survives him, with a son, and 3 daughters. Deceased was an even-tempered, considerate gentleman, and a particularly satisfying recollection of his (to which he often gave voice) was that he never had any trouble with the men under him, whether afloat or ashore.—G."

CURRENT MENTION.—

THE Sperry Engineering Company has been authorized by the proprietors of the New Haven (Conn.) Gas Light Company to construct for it a warehouse on Saltonstall avenue, to have the dimension of 60 feet by 200 feet. It is to be constructed of terra cotta blocks, with gravel roof and fireproof.

THE authorities of La Crosse, Wis. (at least the City Council thereof), recently passed a resolution requesting the Railroad Commission of the State to issue a permit to the Wisconsin Railway, Light and Power Company, enabling that corporation to distribute electric currents for power purpose on any and all accounts. Meanwhile Commissioner John H. Roemer denies the authority of the Commission so to order.

W. D. MARKS certainly "got in right" when the authorities of Minneapolis, Minn., retained him as an expert to "assist" in proving that the rates charged by the Minneapolis Gas Light Company were excessive. The total cost, up to the 21st August, of the "investigation" figures at $32,833.18—especially the 18. Of this gross the aforesaid Marks received $22,238.84—especially the 84—during the years specified: 1909, $1,372; 1911, $2,598.68; 1912, $2,872.86; 1913 (to Aug. 20) $15,405.30. Of course, he has hopes that the current year still has a good "remainder" for him, in that 4 months of 1913 have yet to be registered.

ADVICES to the New York newspapers of recent date are to the effect that, in consequence of a recent adverse decision as to the right of the Omaha (Neb.) Electric Light and Power Company to sell current for power, the authorities are discussing a project for the establishment of a municipal plant. It is asserted that it was not so much the failing to win the lengthy litigation that has disturbed the authorities as the fact that, in confirming the rights of the Company, the United States Supreme Court asserted that these rights were perpetual. The decision, so our informant reports, was the result of an ordinance passed in 1884, requiring the Company to conform to certain rules and regulations. Nothing was said in the ordinance about the life of the franchise; but the Supreme Court now decides that, as the Company accepted the terms of the City Council, and has lived up to them, it has gained a perpetual franchise, not only to sell electric currents for lighting, but also to furnish same for power and heating purposes. The charter expired in 1894, and the city contended that the Company's lighting franchise expired. The Supreme Court says that this was not the case, and that the Company retains its rights, whether it obtains another charter or not. In such respect the decision was very positive and pronounced; but while the Federal Court gave the Company a perpetual franchise, it did not maintain the exclusive feature thereof. And here is where the municipal plant proposers are standing. It is claimed that such a plant, if it derived its power from the Platt or Loup river, would prove a paying municipal investment." Speaking on personal account, our correspondent remarks that it will be a long time before the municipal plant goes into operation, an opinion based on the belief that the taxpayers hold to the view that such a department would be merely a refuge for a bunch of incompetents in the shape of political hangers on.

WILLIAM FILK has resigned from the distribution division of the Guthrie (Okla.) Gas Company.

THE next annual meeting of the National Gas Engine Association will be held in Toledo, O., the first week in December.

THE proprietors of the La Crosse (Wis.) Gas and Electric Company have been authorized to contract with the city for the light and power supply of the new municipal water plant. This action is based on the reports of the city's legal department, that the city had no authority to deal with the Wisconsin Railway, Light and Power Company, owing to specified exclusive rights possessed by the Gas and Electric Company under the State law.

MR. CHAS. F. COX, of Bridgeton, N. J., has been appointed Receiver for the South Jersey Gas Company, of Swedesboro, N. J., on the petition of W. F. Hoffman and others.

MR. DAVID R. PUTNAM, Columbus, O., has been appointed Superintendent of the Raleigh (N. C.) Gas Company. He was formerly connected with the commercial division of the St. Paul (Minn.) Gas Company.

(Continued from page 135.)

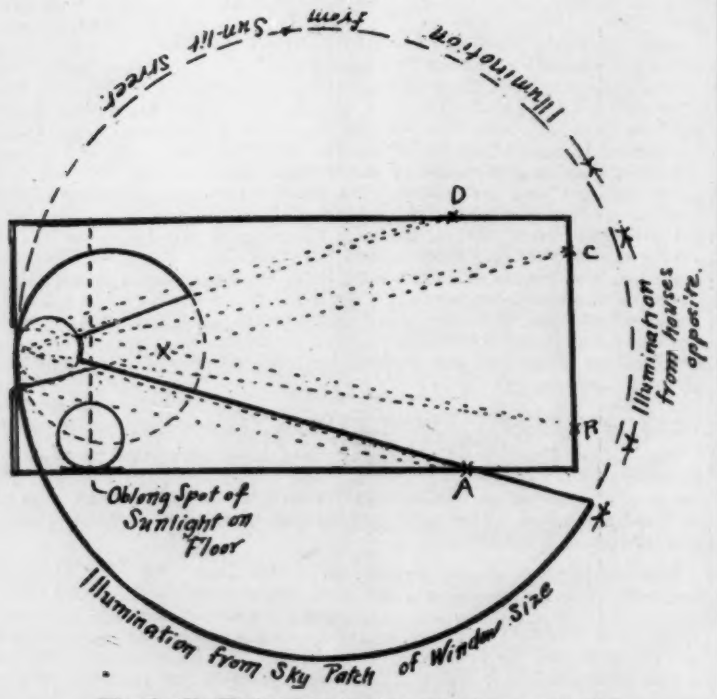


Fig. 4.—The Window Considered as a Point Source of Light.

brightnesses, the distribution of illumination from each of which is represented by a circle of appropriate diameter, tangent to the window. From the brightness measurement of Fig. 3 it appears that these three circles should have, for the most pleasant condition, diameters of about 10-1-3, and they are so represented in it.

A seated person in the room, looking toward the window, sees only the comparatively dull houses opposite. The floor and ceiling are illuminated by a much brighter source, and act as secondary light sources of low brightness. If the sun strikes the floor, the spot becomes another secondary light source. The most startling thing is the very irregular shape of the light distribution curve and its sharp transition, from maximum to minimum, unequalled, I believe, in any commercial lighting unit. Were it not for the fact that the window is large, these sharp transitions would cause sharp contrasts of light and shadow between the portion of wall and ceiling represented at *A*, *B*, *C*, etc.

Distribution from a window tends to diminish the extreme brightness ratio. The greatest illumination is on the floor and furniture, which are the darkest surfaces. With uniform distribution from a side window, and with some artificial systems, the floor and furniture have the brightnesses which their low reflecting powers give them. With two or more windows they are made brighter. This is why with indirect systems the floor and furniture are apt to appear unnaturally dark. To preserve the daylight ratio of brightness above and below, it would be necessary in the indirect system, with its bright ceiling, to have floor coverings and furniture of a 4 or 5-fold higher coefficient of reflection. The excellent appearance of white tiled barber shops under the indirect system is confirmatory of this.

The General Problem.—As an interesting exercise, attention was turned to reproducing artificially the best daylight conditions. The one solution is to reproduce entire the broad expanse of sky, houses and street, but no small light source will copy all these. While it is possible to produce at a given point in the room the general distribution and brightness of daylight, the same scheme will not give the desired effect at another point. The problem is closely akin to that of producing a drawing that would automatically change its perspective as the observer moved. For instance, a horizontal plate above and outside the window would produce the sky effect near the window, but would fail farther back in the room. A vertical plate of low intrinsic brilliancy would take the place of the opposite houses to the eye of an observer within the room, but the sweep of tenfold brighter light across the floor, and the brighter light on the ceiling, would be missing. Several approximations to the conditions were attempted; the first a lighting fixture, the others lighting schemes, or, as a non-technical visitor said, "not lights, but light."

(1) *A Side Wall Fixture to Approximate a Window Effect.*—This fixture might be called "semi-indirect from the side." In construction it is a table lamp with back-half and top of shade removed. It consists of a light source, throwing its light chiefly below and above the horizontal, about as does the prototype window curve, and a large area translucent screen, so calculated that the direct light falls upon the wall behind, the ceiling above, and the whole floor of the room; and of such degree of translucency as to closely approximate the brightness of the illuminated wall behind. (Fig. 5.) The bright part of the light source is not visible, but screen and wall form a large source of low intrinsic brilliancy. The screens, were of flowered silk, or cretonne, lending themselves admirably to the general decorative scheme.

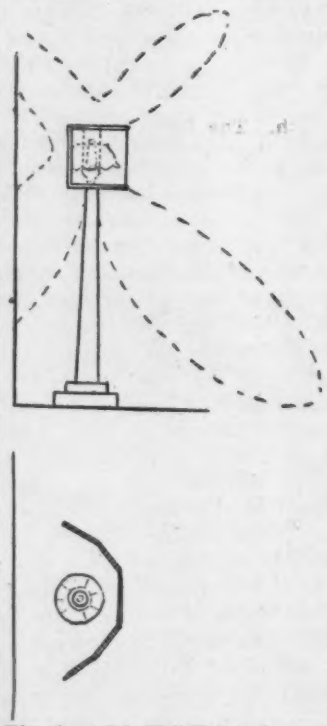


Fig. 5.—A Side Wall Unit to Approximate Window Conditions.

This fixture, in a room having light walls, gives, to a large degree, the desired window effect. The light comes from the side, giving long, pleasing shadows; there is large diffusion, due to the large area of the effective source; the floor and furniture have a pleasant "sun lit" appearance. The limitations of this device are the necessity for bright walls, and the fact that the direct light in the lower hemisphere cannot be made to fall as far out on the floor as with windows, without carrying the shade too far in front of the light. It does, however, make an extremely pleasing light source and has worn well. It is especially good if two or more are grouped at the window end of the room. The best height for the shades, is about the level of the eyes. If a light source must be visible it seems to be less irritating at this line than at some degrees above.

(2) *An Alcove Light with Semi-Window Characteristics.*—In Fig. 6, *A*, is a light source with aluminized scoop reflectors, sending a

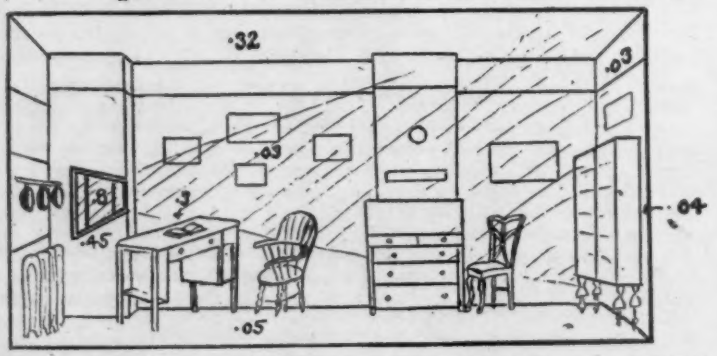


Fig. 6.—A Point Source Copy of Day Lighting. (Brightness Values are Multiplied by a Factor 10.)

large part of their light in the lower hemisphere, and approximating the lower portion of the large circle of Fig. 4; *B* is a frame, 15 inches by 6½ feet, covered with cretonne and muslin sheeting. This to an observer in the room takes the place of the houses opposite, as a large area low brightness source. A thickness of fabric was used such that the illumination through it was one-tenth from the row of lights as seen below it from the floor; that is, the condition found best by daylight. With 7,200 lumens the surface brightnesses through the room measure, on an average, one-twelfth of the average of the two daylight distributions given in Fig. 3. It was found desirable to let considerable light go the ceiling, giving more light in the room, and approximating more to the "sunlight" distribution in Fig. 3. This, when the eye is adapted to night conditions, is very nearly ample at every point of the room. The room presents a strikingly daylight appearance, except for three things First, the line of demarcation between the light, from the "houses opposite" and the "sky," is too sharply marked on the walls; second, the specular reflections on the furniture, books, etc., near the windows, are relatively far brighter than they would be by day, as is to be expected; third, the shadows of the furniture are too sharp. These are all due to the point source character of the light, and are only seen above and below the parts illuminated by the cloth covered screen. The appearance is the same

as obtained by covering all the windows except a narrow horizontal slit. Within the angle which receives light only from the screen and from walls and ceilings, the daylight character is startling.

(3) *A Window Reflector.*—The requirement of a large area, concealed light source at the side, having the distribution curve of the window as a light source, may be approximated by combinations of prisms and reflecting surfaces. To secure the proper unsymmetrical distribution of brightness, recourse was had to reflecting surfaces intermediate between specular and matt. Measurement of scratch-brushed aluminum, aluminum paint, mirror glass covered with transparent curtain material, etc., led to the choice of ribbed mirror glass, sandblasted on the front. Such mirrors, placed with the ribs vertical, and illuminated by a light in front and above, give a large, semi-specularly reflected component, which is so much diffused as to appear to come from a large area of mirror; a small diffuse component, the ratio between the normal and reflected brightness being easily made one-tenth by tilting the mirror.

A pair of frames (Fig. 7) each of four, 7 inches by 30 inches elements, were hung, as in Fig. 8, and illuminated by a row of small units in aluminized concentrating reflectors. As shown in Fig. 7, the specular reflection from the three upper elements illuminates the floors and lower walls. The bottom elements illuminate the ceiling, taking the place of the brightly lit street pavement. An observer sitting in the room sees these surfaces as of a uniform low brightness. On dropping his

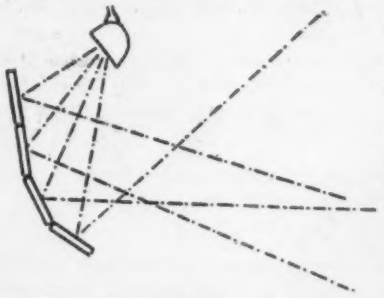


Fig. 7.—Section of Special Reflectors Used for Artificial Window.

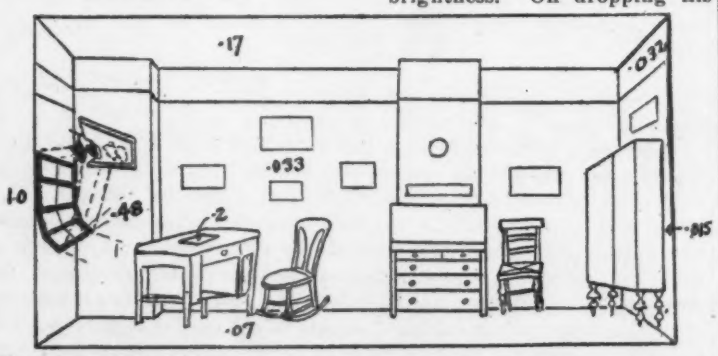


Fig. 8.—Artificial Window Lighting. (Brightness Values Multiplied by Factor 10.)

head he begins to see the top elements brighten, corresponding to the sky appearing over the housetops. On dropping still lower, the other elements brighten until, at the floor, the whole "window" appears a uniform sheet of light. On standing up and approaching the window the lowest elements become bright in the same manner. This copy of window conditions is very close, the reflected light excellently diffused, and the shadows long and soft.

The relative brightness of all visible objects is nearly the same as by daylight without the sun on the floor, as shown in Fig. 3, the actual brightness being close to one-tenth of that of daylight.

Good and Bad Features.—This scheme in some respects is uncanny, to one not looking toward the imitation windows. The sweep of light over the floor, the illumination of the low portion of the walls, the brightness ratio between ceiling and floor are most striking, and very different from the usual artificial light conditions. But the general effect is not pleasing. There is a harsh contrast effect. The darker end of the room looks too dark; the windows too light; the shadows are too inky black. The effect is very much like a foggy day, or as though the houses opposite were brilliantly sunlit. Why is this? In some part due to mental bias, perhaps, the windows do not look just like real windows. The light source is near, instead of distant, and our ocular muscles of accommodation are quite conscious of the real state of affairs. The explanation lies in two facts: First, the absolute intensity is too low; second, the light is not white. The absolute intensity is about one-tenth daylight intensity. My observation leads me to believe that a given physical ratio of brightness becomes subjectively greatly increased, when the order of illumination is decreased as much as it is here. If a ratio of brightness of 10-1, for different points in the room, is satisfactory by daylight, then with 1/10 that illumination this ratio must be decreased to 5-1 or 3-1. With this low order of illumination the shadows on the room side of the face are so dark as to appear nearly black; the high-light side alone is seen. By the greater light of day, although the relative brightness of the two sides of the face is the same, the dark side is bright enough to be easily seen; the bright side does not appear too bright. I can best describe the phenomenon by saying that the room under this 1/10 illumination looks like an under-exposed photograph—the high lights alone come out. By exposing longer, a good negative is obtained; by increasing the illumination tenfold, I believe, unless the color difference has a great deal to say, this copy of daylight would be "the real thing." Physically it measures up in the right proportions. Subjectively, the proportion becomes distorted. I found support for this idea by putting on dark glasses of 1/10 transmission when the daylight conditions were good. The conditions become trying at once. What is called for in the present case is an increase in total light, which cannot be made in the existing house installation without danger. Incidentally it may be remarked that this accentuation of contrasts merely means a larger value for the Fechner fraction at low illuminations, as is actually found by experiment.

The general effect in the room is enormously improved by adding two of the sidewall table lamps described above, placed in the corners next the alcove. These give somewhat more light; but, more than that, they throw their added light upon the ceiling and side walls without increasing the brightness of the "windows." These then cease to be too bright; the shaded side of the face becomes visible and a first rate effect is produced.

On turning off the window light alone, the room seems to jump upward, showing the importance of the daylight effect of the sweep of light on the lower part of the room. I believe this experiment would have been more successful had the room been provided with an artificial window at the side, as such a long, dark room is difficult to light by day. I think another type of room, say a broad, shallow one, with these artificial windows might be quite successful, without an increase in the light. The color of the light may have something to do with the harsh effect. As above noted blue light scatters much better than yellow. The desirable qualities sometimes found in window lighting by daylight are: (1) Direction from the side; (2) soft shadows and low intensity of specular reflection, due to the large size of the source; (3) the direction of a large part of the light on the lower, usually the darker, parts of the room; and, (4) the concealment of the principal light source.

It appears possible to make a very close physical copy of the window as a light source, duplicating all its characteristics. An attempt to do this shows that to the above qualities must be added: (5) Large quantity of light as compared with that usually available from artificial sources. This is less necessary if the artificial windows are placed so as to secure a more uniform distribution of illumination than is necessary by daylight. These various qualities can be separated to some extent into necessities and luxuries; some are necessary for comfort, others appeal to the esthetic sense. I believe that, in concealment of the light source, so that it is not the brightest object visible in making it of large area, and introducing a certain amount of side light from large area, very low intrinsic brilliancy sources, most of the necessary, and many of the attractive, characteristics of daylight can be obtained, with much lower intensity, and, consequently, lower cost than a true copy of daylight. I favor a combination of deck lighting for general floor and working plane illumination, with side wall lights of the type described above. I hope to report on an installation of this type at some future date. If the room is not too large nothing at present promises to excel the side wall window brackets of Fig. 5.

If it were not for the prohibitive cost of an exact copy of good window daylight, it would be a very desirable thing.

The room experimented with has an area of 200 square feet, 1,600 lumens were used, and 10 times that were required, or 16,000. If absorbing screens were used to make this light of daylight color, it would call for about 10 times the amount of light, or 160,000 lumens. Taking the tungsten lamp at 1.5 watts per spherical candle as the light source, 1 watt per square foot is actually used, 10 watts are called for, 100 if subtractive daylight is made (or 20 kilowatts for the room.)

If we could produce white light, with no accompanying invisible radiation or other losses, as by some merger of fire-flies, there should result an efficiency of 330 lumens per watt, or about 40 times that of the tungsten lamp. Since 16,000 lumens are necessary to produce daylight intensity and distribution in this room, there would be required for this ideal white light $\frac{16,000}{300}$, or about 50 watts. This, it is interesting to note, is just about what the builder of the house has provided for in the low-hung, glaring and utterly horrible central fixture. Artificial daylight may not always be a luxury.

London Transportation and Lighting.

In the current issue of *Electrical World*, Dr. Louis Bell, in a communication on these subjects, remarks: There is now a scheme afoot in London which makes railway and tramway managers rub their eyes and wonder where their dividends will be in the near future. Of course, every one knows that the London bus system stretches now over a very wide area; to Windsor, for example. But the new organization, which rejoices in the inclusive name of Greater Omnibus Services, Ltd., has plans which in their bearing on traffic are prodigious.

The scheme in brief is to initiate in every considerable city in England a branch of the new bus service, worked from a central office with interlocking traffic zones so as to give bus communications practically all over the country. The radii from some twenty-one projected centers overlap so that one could travel from Southampton to the Scottish border or from Norwich to Cardiff with comparatively few changes, no more than are needed in a similar distance over American street railways.

Observe the beautiful thriftiness of the project. The bus line has not an inch of track to lay, no overhead structure, no pavements to keep in order and practically no rates to pay. It is a "trackless trolley" with no trolley—a sort of freebooter of traffic rushing in with its whole fleet where plunder promises well, as at a race meet, and scattering later to pick up anything that is not nailed down or red hot in the adjacent counties. Labor, petrol, interest and maintenance on the buses make up the bill of expense—and motor buses pay a petrol tax of only 3 cents a gallon where private cars pay 6 cents.

Already country councils are wondering who will pay for the road repairs, which will grow at a rate to stagger the imagination. In fact, local authorities are even now beginning to plan a campaign of restriction which may be able to force the invader to terms—on the one hand, directed to road repairs; on the other, to the protection of tramways that take care of their own tracks and the rest of the street besides. The local powers to prevent the use of the roads by 5-ton marauders are somewhat limited, but there remains, by an almost facetious turn of fate, the right to prevent taking up or setting down passengers in the local domain. It is a credit to the English sense of justice that in Oxford such rights have been enforced to protect the interests of a tramway company which has been paying liberally for its use of the streets.

By the way, there still remains in Hastings a tramway of the sectionalized, magnetic-switch variety, working, I am told, rather badly, but unable to change to an overhead trolley on account of the local authorities, or to a slotted conduit on account of the invading sea. Between the board and the deep sea it is rather hard pushed.

The lighting of London has changed wonderfully in a few years and in remarkable ways. Part of the metropolis is a carnival of pressure gas, another part a symphony in flame arcs, and for the rest—well, if there is any co-ordination between sound and light then the streets of London remind one of the state of Babel after the grand catastrophe. Yet one must admit that, though the kinds are many, each after its particular fashion is good. The chief streets of London are, in fact, remarkably well lighted, and even the secondary streets rather better than in America. The tertiary lighting is not so good.

The best of the lighting is by magazine flame arc lamps and by very high pressure gas. Here the long-burning flame arc lamp has hardly a show. When a 550-watt magazine lamp can give in the useful direction more than 3,000 candle power and requires recharging only every 75 hours or so, the long-burning carbon lamp at its wonted efficiency ceases to be attractive where electrodes can be imported free. A few of the long-burning lamps are in service, but it is the magazine lamp that is pushing to the front.

One good stretch of street is lighted with high candle power tungsten lamps, three grouped in a single lantern and replacing a big arc lamp with admirable effect. Beside all these the old carbon lamps, of which some still survive, seem about as luminous as white beans. The gas lamps are as various and interesting as the electric ones. Pressures are carried up to even 80 inches of water, and with, of course, corresponding economy in gas. The most interesting thing, however, is the carrying of the powerful gas lamps on cross suspension. The pipe from the side is a solid one to which the lamp, carried on a trolley from the suspension, is affixed by an automatic connector so that the lamp may be dropped out of connection and trolleyed to the sidewalk for inspection or repair.

Tungsten lamps are seen everywhere, operated mostly at 220 volts, as fits the major part of the distribution systems. They come from all the corners of the Continent from makers scarcely heard of across the sea, and I have a strong suspicion from what I hear that they are mostly indifferent, benevolently dumped perhaps on the English market. Of course, the best of English lamps are excellent, but the situation in London shows at least one of the possible results of too much competition.

Methane in Water Gas.

The "Comptes Rendus" of the French Academy of Sciences contains details of some experiments by M. Leo Vignon, studying the conditions attending the formation of methane in water gas. Water gas always contains a small quantity of methane—a fact which had been recognized by Clément and Désormes, as well as by Langlois, and M. Armand Gautier who had demonstrated that hydrogen reacts upon carbon monoxide, at temperatures from 400° to 1,200° C., to form very small quantities of methane.

M. Vignon began by making some water gas with two samples of coke (A and B), and one of carbonized sugar (C). He then determined the quantity of ash from the three samples, and estimated the lime in the ash, with the following results:

A.—Ash,	10.60	per cent.; lime,	7.33	per cent.	of ash.
B.—Ash,	8.70	" "	8.47	"	"
C.—Ash,	1.22	" "	0.80	"	"

The two cokes gave water gas containing on an average (carbon monoxide and carbon dioxide deducted) 96.55 per cent. of hydrogen and 3.45 per cent. of methane; the carbonized sugar giving more than 98 and less than 2 per cent., respectively. M. Gautier had obtained from the reaction of hydrogen on carbon monoxide:

	At 400° C.	At 1,300° C.
Hydrogen	99.80	98.65
Methane	0.20	1.35

In making water gas with carbon very poor in lime, M. Vignon obtained a gas containing less methane than that produced from gas coke; the proportion being similar to that found by Gautier. This led him to investigate the influence of lime on the composition of water gas. He had already studied the decomposition of steam by carbon in presence of lime, and communicated the results to the Academy. Under the conditions described, considerable proportions of methane were formed at the expense of the carbon monoxide. The experiments referred to were made at temperatures of 600° to 800° C., below the point for the decomposition of carbonate of lime. Those now described were carried out at the normal temperature for the formation of water gas.

The first series were made with 100 grammes of coke, with 10 per cent. of lime. Passing steam through the mixture at 1,000° C. produced a gas containing an average of 88 per cent. of hydrogen and 12 per cent. of methane. In the second series, 15 per cent. of lime was used, and the resulting gas contained 81 per cent. of hydrogen and 19 of methane. In the third series, the proportion of lime was 50 per cent., and the gas contained 77 per cent. of hydrogen and 23 of methane.

He then caused the constituent elements of water gas to act upon lime at about 1,000° C. in order to elucidate the mechanism of the formation of methane, and he gives details of the results. The origin of methane is found in the following reactions:

$$(1)—4(CO) + 2(H_2O) = 3(CO_2) + CH_4.$$
$$(2)—2(CO) + 2(H_2) = CO_2 + CH_4.$$
$$(3)—CO_2 + 4(H_2) = CH_4 + 2(H_2O).$$

The second reaction takes place directly in very small proportions, as demonstrated by M. Gautier.

In the production of water gas from coke, the lime intervenes, and the percentage of methane increases in larger proportions. Below 800° C. the formation of carbonate of lime is an important factor in the production of methane. Above the temperature of decomposition of carbonate of lime—*i.e.*, above 900° C.—lime acts as a catalyzer favoring the three reactions given above.

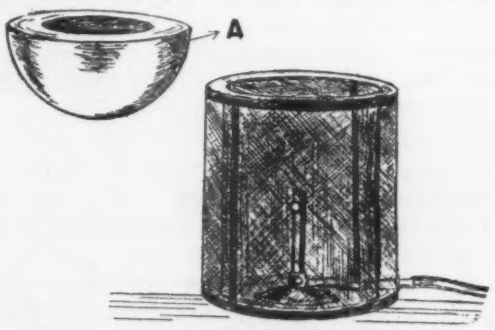
MR. NICHOLAS F. BRADY (son of the late Anthony N. Brady) has succeeded his father in the Directorate of the New York Mutual Gas Light Company.

Safe Distillation of Carbon Bisulphide.

Mr. A. R. Myhill, of Birmingham, England, in the following valuable note on this subject, prepared by him for the *Journal of Gas Lighting*, says: In a gas works laboratory, it is frequently necessary to distill carbon bisulphide—as when testing spent oxide, or other work involving the extraction of tar or sulphur. Anyone who has had experience of this kind knows the difficulty of preventing the volatile liquid from catching fire during distillation. To boil CS_2 in a flask over a bare flame is to court disaster. The temperature at which ebullition takes place is so low that a bunsen flame—even when turned so low as to light back—may in some cases cause such violent boiling as to blow out the cork of the flask and allow the heavy vapor to catch fire. Even if this does not take place, it will be found difficult to prevent slight leakage of vapor round the cork, as CS_2 penetrates almost anything.

Carbon bisulphide distils at a temperature considerably below that of steam; so that it is only necessary to place the flask or retort on a bath through which steam is passing, but even in the absence of a flame, fires frequently take place. I believe steam at 100° C. is capable of setting fire to CS_2 vapor, and many accidents owe their origin to this cause.

The apparatus shown in the cut has been used with complete success in a small laboratory where there is no steam. Its construction is very simple. The main portion is merely a cage, made of fine iron wire gauze stretched over and riveted on to a metal framework. Doubtless copper would be more serviceable, although it has not so far been tried. Two cylinders are employed—one concentric with the other, and about ¼ inch from it. The two are joined top and bottom by rings of brass or other suitable metal. The mesh of the gauze is the same as that used for miner's safety lamps, and the two gauzes are necessary as the flame sometimes passes through one thickness.



Near the bottom of the cage, a short piece of ¼-inch copper tube is soldered in, so as to allow a bunsen burner inside to be connected to the gas supply. A hemispherical copper bath, *A*, rests on the open top of the cage. It should be a good fit; so as not to allow any of the flame underneath to ascend, or any CS_2 vapor to descend into the gauze cylinder.

A is filled with water; the bunsen burner lighted; and the flask of CS_2 placed in the water. As soon as the water shows signs of reaching the boiling point, the flame is lowered, or, if the volume of CS_2 is small, turned out altogether, when the heat will cause all the solvent to boil away gently and without danger.

New Methods and Appliances.

Illuminating the Panama Exposition.—The illumination of the Panama Exposition, to be held in San Francisco from February 20 to December 4, 1915, will strike a new key. Outline lighting, with its glare and dark spaces, will not be used, but in its stead, both direct and indirect lighting will be employed, with highest artistic effect, and with all dark shadows eliminated. At night the exposition palaces, and the details of their facades and statuary, will be seen with daylight clearness. Great paintings upon the walls will appear in their true color values. Perfect reflections of whole buildings will be produced in the lagoons. In the harbor before the grounds, will be batteries of colored scarchlights trained against the towers and minarets, and against the reflecting glass jewels which will be a leading feature of the illumination.

The plan of illumination is in charge of W. D.'A. Ryan, director of illumination, who supervised the illumination of the Hudson-Fulton celebration and of Niagara Falls, and who is directing the illumination of the Panama Canal. Mr. Ryan is working with Jules Guerin, director of color, who has conceived a marvelous color scheme which assures that there will be no dead white upon the exposition grounds.

There will be four principal sources of light at the exposition; great batteries of searchlights mounted on pontoons in the harbor; masked batteries of searchlights on the roofs of the exhibition palaces; an indirect system of lighting behind the colonnades by which the statuary, mural decorations and facades of the buildings will be illuminated; and radiant groups of statuary in the courts, and throughout the grounds. The interior of the buildings will be lighted with arcs. The direct lighting will be thrown on the facades and sides of the buildings.

The walls behind the colonnades in the various courts will be decorated with mural paintings, which will be illuminated by electric globes placed in recesses in the backs of the columns. These lamps will not be visible from the floors of the colonnades or from the courts, being set in the columns at heights of 10, 20 and 30 feet. The illumination of the paintings will be controlled by changing the size of the light units, and the curvature of the mirrors that reflect the lights against the walls. Kaleidoscopic effects will be obtained by introducing colored bulbs. A special type of tubular lamp has been developed for fluted columns.

The Pacific Gas and Electric Company has contracted to supply all the electricity, gas and steam that will be used during the exposition. This contract represents considerably more than a million dollars, and is the largest that has yet been entered into by the exposition company. It provides that the fair company shall use a minimum of 12 000-horse power during the period of construction and 20,000-horse power during the exposition.

A mammoth generating plant will be erected on the exposition site and will serve the dual purpose of generating power for the exposition and of the Company's special exhibit. After the exposition, the generating plant will be used by the Pacific Gas and Electric Company as a sub-station.

Adaptability of Automatic Water Heaters.—One of the many uses found for automatic water heaters is illustrated in the accompanying cut.

This shows the water heater installed in an ice cream factory, for washing cans, in which plant a large number of cans are handled daily, and the labor of washing and sterilizing them is no light one. Previous to installing the automatic heater the usual tank with water heater was in use, but this necessitated a large amount of handling of cans, and a much larger quantity of hot water than is actually necessary to remove the congealed cream from the cans, and to sterilize them properly. To effect economy in labor, as well as fuel and water, the management adopted this up-to-date method, and now cleanse the cans and sterilize them at the same time by a jet of water supplied from the city main through the automatic gas water heater. The heater is adjusted to supply water at about 140° F., and the force of the jet is such that 20 seconds is sufficient to thoroughly cleanse a 10 gallon can. The heater is installed in the regular manner, excepting that the supply, instead of being led to a faucet, is connected to a vertical jet which passes through a shelf. The cans when inverted over the jet are subjected to the full force of the water for as long as may be necessary, and the hot water after cleansing the cans is collected in a tub below the shelf or run to the waste. This is a decided sanitary improvement, as in this method of washing cans it is not necessary that they be touched with the hands, and absolutely clean water is used for each can; and the manufacturer may use this point as a feature of his advertising.

Tackle for Use in Painting Gasholders.—Mr. George W. Anderson, of Westminster Chambers (London, England), in an interesting letter to the *Gas World*, evoked by his having read an account of an accident at Stratford last month, in which, through the failure

of tackle used in the painting there of a holder, three men were lost, said he used a cradle, depending altogether on a bos'un's chair. He passed a rope through a strong block fixed to the highest point of the framing and pulls the chair, when empty, up to about 3 feet from the block. Then to the rope, at the ground level, sufficient weight is attached to balance the weight of the man who is at work in the chair, hauling the latter down and tieing it to the foot of the standard. The apparatus is thus ready for work. When about to commence work the man gets into the chair, ties it to the foot of the standard, and with one hand pulls himself up to the position desired. On reaching the level at which he is to work, he ties the two ropes together with a piece of string, and is quite safe. Naturally, it is a requisite that the rope shall be in good condition and the block in proper order. Continuing, Mr. Anderson says: "The first time I tried this was at the Mortlake works of the Sydney Gas Company, where, previous to this, it had been the practice for blocks and tackle to be used, a man standing on the ground level to attend to the man painting. When I proposed my balancing system, I had difficulty in getting men to adopt it, as they said they felt safer having a man watching them. By granting an extra 25 cents per day, two men undertook the work, while the rest of the men followed their old custom. The following day I had a deputation from the men, stating that if I would give an extra 25 cents per day to all of them, they would work with the balancing system. I declined, however, to give these men this extra money, and they then decided that they would adopt my system, as they saw from experience that the men were much safer than with the block and tackle arrangement. There is no reason, of course, why the cradles should not be continued in use, provided they are balanced, for the security one feels compared with the other system is extraordinary. By the use of a fairly large wheel in the block, the wear-and-tear of the rope is very much reduced."

Book Reviews.

The Thomas Moulding Brick Company.—In these days, when the proprietors of gas companies are alive to the fact that suitable office quarters, in their own buildings, located in the business centers of their respective settlements, are well worth while, the artistic fireplace cuts quite a figure in the architect's arrangings. As an aid to these room ornamentings, most builders, or those projecting office headquarters, will find "Brick Fireplaces" a decided aid towards making a selection. Mr. R. M. Thomas, Vice President of the Thomas Moulding Brick Company, Chamber of Commerce Building, will be pleased to forward a copy of the handsome pamphlet to anyone interested.

Year Book, the Pennsylvania Gas Association.—Secretary Lamson is to be congratulated over his success in getting out the Proceedings of the Fifth Annual Convention of the Pennsylvania Gas Association. The book proper covers 123 pages, and the compiler evidently put into his work much editorial effort, that adds greatly to the reader's advantage in scanning the book's chapters. Well printed and well bound, it is on such accounts made all the more attractive; and those who go through it carefully will agree with us over our prior comment that the Pennsylvania's fifth session was interesting and instructive. Secretary Lamson's compilation includes an excellent index by speakers; and the story-at-length of the proceedings is properly and pleasantly preceded by an excellent picturing of the Association's then President, hearty, wholesome Henry H. Ganser.

The Wisconsin Association's Journal of Proceedings.—Careful, methodical Henry Harman, Secretary of the Wisconsin Gas Association, is also to the fore with that excellent body's "Journal of Proceedings," which carries within its covers the well-told narrative of the 12th meeting, held last May in Milwaukee. Like the Lamson method of compiling, Secretary Harman's work is marked by thoroughness and carefulness, the result being a brochure that completely narrates the good, useful, lasting work performed in the convention days of last May. The book carries a list of members, which shows that the Wisconsin Association now has for champions 98 in the active and 89 in the associate class, respectively. The volume will be of worth to everyone connected with the industry, notably (if for no other reason) for the reproduction *in extenso* of the masterly address delivered by Mr. Erickson, of the Wisconsin Railroad Commission, whose clever communication was chiefly (and forcefully) concerned with the "Importance of Uniform Accounts and Statistics."

Items of Interest
FROM VARIOUS LOCALITIES.

MR. PIERRE PLANTINGA, of The Gas Machinery Company, Cleveland, O., sailed for Europe, via the "New Amsterdam," the morning of Tuesday last. His visit will take about 10 weeks' time.

THE MacArthur Concrete Pile and Foundation Company, of New York, has been awarded a contract for constructing the foundations for the new retort house and other buildings to be erected by the Mohawk Gas Company, Schenectady, N. Y. About 500 pedestal concrete piles will be driven. This by-the-way is the second pile contract recently awarded the MacArthur Company by the proprietors of the Mohawk plant, the first having been the pile foundation for the 2,000,000 cubic feet capacity holder, all under the direction of the Mohawk Company's Superintendent, Mr. V. Starzenski.

THE initial hearing before the Public Service Commission, lower New York district, on the petition of the New York Edison Company and of the Astoria Light, Heat and Power Company, to increase their respective stock and bond issues, will be again taken up tomorrow. The postponement was had to enable the engineers to check up the Company's statement regarding additions to fixed capital. All the shares of the Edison Company, and all the stock and bonds of the Astoria Light, Heat and Power Company, are owned by the Consolidated Gas Company.

AT the special election recently held in Omaha, Neb., for the purpose of determining whether or not the franchise of the Omaha Gas Company should be extended for a period of 25 years, the franchise was rejected by a vote which tallied 7,046 against to 4,127 in favor.

THE San Francisco *Call* says that during the current year the Pacific Gas and Electric Company will expend on construction account the estimated sum of $13,721,000. The items in connection with this huge expenditure include $3,854,354 for the South-Yuba hydro-electric development, including the Lake Spaulding and Bear river construction; $2,267,818 for the installing of three power houses in the Placer district; and $1,129.633 for the steel tower transmission line from the Drum power house, to the sub-station at Cordelia. The Company avers that the physical value of its properties is not far from $114,000,000, but within comparatively short time the actual value will be made known, the Company having agreed with the State Railroad Commission that, before applying for the right to issue additional securities, it will file with the Commission an appraisement of its properties, to facilitate any investigation that the Commission may deem advisable in connection therewith.

IN relation to the above *The Call* notes that the Pacific Gas and Electric Company has outstanding underlying bonds, and its general and refunding bonds, amounting to $75,858,800, with $4,500,000 outstanding notes. In addition are these stock obligations: Preferred stock, 6 per cent., $10,000,000; common stock, $31,998,750 in the hands of the public, and $31,696,866 common stock, owned by the San Francisco Gas and Electric Company.

A TRANSCRIPT from the Allen County Circuit Court, asking the Federal Court to appoint a receiver for conducting the affairs of the Kerr Murray Manufacturing Company, of Fort Wayne, Ind., has been filed in the Federal Court. The case is docketed under the caption, "George H. Cressler *vs.* Kerr Murray Mfg. Company."

AT a meeting of the City Council, Indianapolis, Ind., held some evenings ago, a resolution was adopted giving the Committee concerned in the premises "Authority to inquire into the advisability and desirability of purchasing, leasing and operating the plant of the Indianapolis Gas Company and that of the Citizens Gas Company," which evidently opens the way for the establishment of a municipal gas enterprise. The resolution calls for the employment of experts, etc., necessary to reach a fair conclusion.

ON August 7th, John Yablonsky completed 50 years of service in the San Francisco district of the Pacific Gas and Electric Company. The veteran is in Europe, on a trip to his native (Hampton Court, England) place, where he was born in 1834. He came to San Fran-

cisco, by the Cape route, arriving there in the summer of 1850. Aug. 7th, 1863, he became a member of the force of the San Francisco Gas Company, serving first as janitor, and later on and successively as statement reader and collector. He was such a success in the latter roll that he went from door-to-door for 40 years, until 1912, when a berth was found for him in the records' department. To show that the veteran does not believe in slow-going we have merely to mention that his trip over was on the "Mauretania," and that "Imperator" will bring him back. For the main facts here recited we are indebted to the August issue of the excellent "Public Service Magazine," published under the direction of the Pacific Gas and Electric Company, and the editorial supervision of our own John A. Britton.

Mrs. Margaret Layman has been appointed to the vacancy on the administrative force of the Northumberland (Pa.) County Gas and Electric Company, vice Miss Vera Heagy, resigned.

The contract for the foundation, on which is to rest the storage holder recently contracted for by the Gas and Electric Commissioners of Norwich, Conn., has been awarded to Mr. A. N. Carpenter.

The authorities of Albany, Ore., have granted to Mr. G. L. Rauch (Attorney for a Portland concern to whom a gas works' franchise was issued some months ago) an extension of time respecting construction of a gas plant in the named place. Mr. Rauch's main plea in connection with the failure to go on with the work as originally contemplated and prescribed was the difficulty experienced in financial circles to interest capitalists in new enterprises of any sort, no matter how promising these might appear.

Manager Whittaker is completing the placing of 2 benches of 6's in the generating plant of the Utah Light and Railway Company, at Ogden, Utah. The holder is virtually completed, and Manager Whittaker is much pleased over the way in which the betterment scheme agreed upon last spring is being carried out.

The Receiver's sale of the plant and properties of the Seaford (Del.) Gas Company will be held in Seaford at noon to-morrow.

The Lawrence (Mass.) Gas Generator Company has been incorporated by Messrs. G. A. Mahoney, A. H. Benoit and Jno. F. Mahoney. It is capitalized in $10,000.

The Boston Consolidated Gas Company has placed an order for 3 Studbaker delivery cars to be used in connection with the operation of its meter service.

Superintendent William H. Leonard is "enjoying a vacation," which has taken on the shape of some very close direction of additions to the Milford (Mass) Gas Light Company's distribution system. When these have been completed (which happening will likely occur before mid-September) the residents of the Hopedale section will have a gas supply for which they (or at least many of them) have long been anxious

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At a meeting of the shareholders in the Meriden (Conn.) Gas Light Company, held to consider the acceptance of an amendment to its charter, permitting it to increase its capital stock to $1,000,000, from $500,000, the order of acceptance was unanimously ratified.

This despatch, dated from New York, the 23d ult., was widely circulated in the newspapers of the country: "As a result of heavy demand on mid-continent oil fields, and of slightly decreased production in July, prices have been further advanced 5 cents per barrel, or to $1.03, the highest price since 1904. Since the first of the year mid-continent oil has risen 20 cents, and within the last 12 months 33 cents, or about 50 per cent. Since July 1st mid-continent crude had advanced 10 cents before the last 5 cents increase, 'to give impetus to drilling." But production in July showed only slight increase over June, which, being only 30 days in length, the daily average runs showed a slight decrease. July, for the first time in 1913, showed the Prairie Oil and Gas Company's deliveries to exceed its runs; but within a few months the completion of its pipe line facilities will result in further heavy increases in Prairie shipments, and, if it is to maintain its surplus, a marked increase in new production will be necessary. The mid-continent field, which includes Kansas and Oklahoma, is now looked upon as the most important in the United States. The Appalachian fields formerly furnished all the high grade petroleum, and the highest grade thereof is still shipped from Pennsylvania; but, despite the highest prices on record, it seems impossible to increase the production in that field. The production of the Pennsylvania, Lima, Kentuky and Illinois fields for the first seven months of the year, as reported by the pipe-line companies, amounted to 7,747,461 barrels, as compared with 8,728,796 barrels during the corresponding period of 1912. As the best grade comes from Kansas and Oklahoma, the country has practically and naturally turned to that field. At the beginning of this century the mid-continent region was relatively unimportant; in fact, in 1900 it produced only 74,714 barrels. However, if nothing untoward should happen, the output of the Prairie Oil and Gas Company should exceed 35,000,000 barrels; and indications are that operations in the mid-continent field will be much more active than those heretofore reported."

Evidently this carefully prepared notice can be traced to the Chief of the powers that rule the oil trade; and while a thin veil of pessimism colors the tale all through, the absolute fact is that gas makers, in this section of the country at any rate, can secure "enriching" oils at quite decidedly better rates than those "freely but hastily" offered, say last March.

The laying of gas mains in connection with the supply of gas to the residents of Mexia, Tex., will be completed by November 1st, and it is also declared that the gas plant now being constructed there will be in readiness to operate about the same date.

"B. G. M.," writing from Spokane, Wash., under date of the 18th August, forwards the following syllabus of the compromise between the Spokane Gas Company and the local authorities over the gas supply of that city: First; the city is to be paid $16,182.80, in settlement of past payments of royalties on franchise account; second, hereafter the city is to be paid 2 per cent. per annum on gross earnings; third, the Company will not appeal from gas schedules sanctioned by the State Public Service Commission; fourth, the city agrees that the Company shall have the right to reopen the rate question when the subject will again be considered by the State Commission, October, 1914; fifth, it is agreed by the city that it shall not attempt to repeal the 1902 franchies until the termination of the litigation between one Charles Theiss and the Company; sixth, the Company may appeal from the findings of the State Public Service Commission as to the valuation of it possessions.

An amicable settlement, between the Indiana Fuel and Light Company and the authorities of Auburn, Ind., has been reached. Our informant states further that it is likely the basis of settlement will be the payment of 2 per cent. on the gross receipts of the Company for and since the period following the first 5 years of its operating in Auburn.

The authorities of Jacksonville, Ills., are insisting that the local Gas Company shall sell gas at $1 per 1,000 net; but the Company is equally insistent on $1.20, gross, or $1.10, net. The present rate is $1.25, gross, or $1.15, net. And to those at a distauce, but well acquainted with the situation as it exists, the present situation would seem not at all beyond the pale of fairness.

Mr. J. H. Roemer, Chairman of the Wisconsin Railroad Commission, after an investigation of the circumstances attending the supply of gas in Milwaukee, declares that the Gas Company has 2,800 small consumer accounts on its books that, at present rates for gas supplied, cannot yield any profit to it; and that a large proportion of such accounts must result in actual loss.

Recent Patent Issues.

Prepared for the American Gas Light Journal by Royal E. Burnham, solicitor of patents and counselor in patent causes, 833 Bond Building, Washington, D. C., from whom illustrations and specifications of any patent mentioned below may be obtained for 20 cents.

1,069,681. Gas Valve Shut-Off. J. Dub, Cleveland, O.

1,069,702. Mechanism for Producing Gas-Lighted Flash Signs and the Like for Advertising Purposes. T. Jackson, New Cross, London, England, assignor to himself and A. Ramsey, Folkestone, England.

1,069,783. Gas Flame Spreader. E. R. Hodges, Indianapolis, Ind., assignor of one-half to T. Bemis, same place.

1,069,866. Method of Operating Gas Producers. H. L. Doherty, New York City.

The Market FOR GAS SECURITIES.

It is the unexpected that seems always to happen in connection with Exchange trading in Consolidated gas. Early in the week these shares were utterly neglected, and the "operators for the decline" were quite pessimistic over the outlook; but towards the end (and particularly this Friday morning) the quotations as to the bid were advanced two points, to 132. At that the quotation is very much below its true value; and it is the belief of many experienced and careful financiers that Consolidated should readily sell on a 4 per cent. basis, or 150.

Brooklyn Union is steadier and higher; save the mark! If 127 to 130 respresents anything like its intrinsic value, then value basis is all wrong. The Consolidated Company, of Baltimore, has declared the regular semi-annual of 3 on the preferred and also a quarterly of 1½ on the common, both payable the 1st prox. Its annual meeting will be held the 23d inst. Washington (D. C.) gas is steady, at 420 bid. Peoples, of Chicago, is at last getting to the point where quotations are somewhat reflective of its real value; it came in to-day at 118 to 118½. Lacledes are steady, with an occasional transaction reported. Massachusetts gas is slowly getting back to its normal value. Pacific Gas and Electric continues to show weakness, having sold below 40 last Wednesday. Thursday $4,000 Equitable 5's were sold on the Philadelphia Exhange at 104½; and that figure was bid for $5,000 additional. U. G. I. keeps on the even tenor of its way.

Mr. N. F. Brady has succeeded his father (the late Mr. A. N. Brady) on the Directorate of the New York Consolidated Gas Company. A specialty stock that has been making steady gains of late is that known as Gas and Electric Securities, the common of which is bid for at 95. The Laclede Company's regular 1¾ on the common is payable the 16th inst.

Gas Stocks.

Quotations by George W. Close, Broker and Dealer in Gas Stocks.

115 BROADWAY, NEW YORK CITY.

SEPTEMBER 1.

☞ All communications will receive particular attention.

☞ The following quotations are based on the par value of $100 per share:

N. Y. City Companies.	*Capital.*	*Par.*	*Bid.*	*Asked*
Consolidated Gas Co.	$99,816,500	100	132	132¼
Central Union Gas Co.—				
1st 5's, due 1927, J. & J.	3,500,000	1,000	101	103
Equitable Gas Light Co.—				
Con. 5's, due 1932, M. & S.	1,000,000	1,000	105	106
Mutual Gas Co.	3,600,000	100	157	157
New Amsterdam Gas Co.—				
1st Con. 5's, due 1948, J. & J.	11,000,000	1,000	99	101
New York & Richmond Gas				
Co. (Staten Island)	1,500,000	100	59	62
1st Mtg. Gold Bds. 5 p. ct.	1,500,000	—	98¼	100½
New York and East River—				
1st 5's, due 1944, J. & J.	3,500,000	1,000	103	105
Con. 5's, due 1945, J. & J.	1,500,000	—	96	100
Northern Union—				
1st 5's, due 1927, J. & J.	1,250,000	1,000	100	102
Standard	5,000,000	100	102	104
Preferred	5,000,000	100	93	94
1st Mtg. 5's, due 1930, M. & N.	1,500,000	1,000	90	95
The Brooklyn Union	15,000,000	1,000	127	130
1st Con. 5's, due 1948, M. & N.	15,000,000	—	105¾	107
Yonkers	299,650	500	120	—
Out-of-Town Companies.				
Binghampton Gas Works	450,000	100	—	—
" 1st Mtg. 5's	500,000	1,000	97	100
Boston United Gas Co.—				
1st Series S. F. Trust	7,000,000	1,000	82	85
2d " " "	3,000,000	1,000	47½	50
Buffalo City Gas Co.	5,500,000	100	5	6
Bonds, 5's	5,250,000	1,000	59	60
Capital, Sacramento	500,000	50	—	35
Bonds (6's)	150,000	1,000	—	—
Chicago Gas Co. Guaranteed				
Gold Bonds	7,500,000	1,000	104	106¼
Columbus (O.) Gas Co., 1st				
Mortgage Bonds	1,500,000	1,000	96	98
Columbus (O.) Gas Lt. &				
Heating Co.	1,683,750	100	90¼	91
Preferred	3,026,500	100	75¼	80
Essex and Hudson Gas Co.	6,500,000	—	133	136
Fort Wayne	2,000,000	—	—	—
" Bonds	2,000,000	—	55	—
Grand Rapids Gas Light Co.,				
1st Mtg. 5's	1,350,000	1,000	100	101
Hartford	750,000	25	190	200
Hudson County Gas Co., of				
New Jersey	10,500,000	—	130	133
" Bonds, 5's	10,500,000	—	104	106
Indianapolis	2,000,000	—	7	30
" Bonds, 5's	2,650,000	—	20	93
Jackson Gas Co.	250,000	50	82	—
" 1st Mtg. 5's	290,000	1,000	97	100
Cincinnati Gas and Electric				
Co.	29,500,000	100	87	90
Kansas City Gas Light Co.,				
of Missouri	5,000,000	100	—	86
Bonds, 1st 5's	3,822,000	1,000	98½	99
Laclede Gas Co., St. Louis.	10,000,000	100	95	100
Preferred	2,500,000	100	—	102½
Bonds	10,000,000	1,000	102½	103
Lafayette Gas Co., Ind.	1,000,000	100	—	60
Bonds	1,000,000	1,000	60	65
Louisville	2,570,000	50	120	130
Madison Gas and Electric Co.				
" 1st Mtg. 6's	400,000	1,000	108	
Massachusetts Gas Companies, of Boston	25,000,000	100	91	91½
Preferred	25,000,000	100	91	91½
Montreal L. H.& P., Canada	2,000,000	100	210	212
Nashville Gas Light Co.	1,000,000	100	110	—
Newark, N. J., Con. Gas Co.	6,000,000	—	97	98
Bonds, 6's	6,000,000	—	127	128
New Haven Gas Co.	5,000,000	25	182	190
Peoples Gas Lt. & Coke Co.,				
Chicago	25,000,000	100	118	118½
1st Mortgage	20,100,000	1,000	102	102½
2d "	2,500,000	1,000	104	—
Rochester Gas & Electric Co.	2,150,000	50	88	—
Preferred	2,150,000	50	118	—
Consolidated 5's	2,000,000	—	104½	105½
Pacific Gas and Electric Co.	15,500,000	—	39½	39¾
St. Joseph Gas Co.—				
1st Mtg. 5's	1,000,000	1,000	93	93
St. Paul Gas Light Co.	2,500,000	100	—	—
1st Mortgages, 6's	650,000	1,000	104	105
Extension, 6's	600,000	1,000	112½	115
General Mortgage, 5's	3,447,000	1,000	94	96
Syracuse Gas Co., N. Y.	1,975,000	100	50	55
Bonds	2,047,000	1,000	101	103
United Gas Imp. Co.	55,502,950	50	172	174
Washington (D. C.) Gas Co.	1,600,000	200	420	430
1st Mortgage, 6's	600,000	—	—	—
Western Gas Co., Milwaukee	4,000,000	—	—	—
Wilmington (Del.) Gas Co.	600,000	50	—	—

MEETING TIMES OF THE VARIOUS GAS ASSOCIATIONS.

American Gas Institute.—Annual meeting, Richmond, Va., October 15-17, 1913. Officers: President, W. R. Addicks, New York City. Secretary, Geo. G. Ramsdell, 29 West 39th st., N. Y. City.

Canadian Gas Association.—Annual meeting Sept. 1913. Officers: President, Arthur Hewitt, Toronto, Ont.; Secretary and Treasurer, John Keillor, Hamilton, Ont.

Empire State Gas and Electric Association.—Annual meeting, New York City, Oct. 8, 1913. Officers: President, C. G. M. Thomas, Long Island City, N. Y.; Secretary, C. H. B. Chapin, 29 W. 39th street, New York City.

Gas Meters.—Monthly Section Meetings; Grand Commissioner, Will. W. Barnes, East Orange, N. J.; Gen'l Sec'y, H. Thurston Owens, La Crosse, Wis.; New York Section, Chairman, W. H. Pettes; Secretary, G. E. Smith, Sipp Avenue, Jersey City, N. J. Philadelphia Section; Chairman, Stanley Grady; Secretary, H. E. Stiteler, Broad and Arch streets. Cleveland Section, Chairman, F. R. Hutchinson; Secretary, Wm. Holtz, East Ohio Gas Co. New England Section, Chairman, T. W. Jennings, Boston; Sec., F. K. Wells, 60 Broad street, Boston. Winona Section, Winona, Minn., W. F. Clausen, Chairman. Bethlehem Section, Trueman Weithnecht, Chairman; Sec.-Treas., Truman Buss, South Bethlehem, Pa.

Guild of Gas Managers of New England.—Annual meeting, March, 1914. Young's Hotel, Boston; monthly meeting, second Saturday. Officers: President, Walter G. Africa, Manchester, N. H.; Secretary, H. K. Morrison, Brockton, Mass.

Illinois Gas Association.—Annual meeting, March 18th and 19th, 1914. Chicago, Ills. Officers: President, W. F. Barrett, Chicago, Ills.; Secretary-Treasurer, Horace H. Clark, 115 No. Oak Park avenue, Oak Park, Ills.

Illuminating Engineering Society.—Annual meeting,———— September, 1913. Meetings of Sections, monthly. Pres., Preston S. Millar; General Secretary, J. D. Israel, 29 W. 39th street, New York City. Sections: New York, Secretary, C. L. Law, 124 West 42d street. New England, Secretary, H. C. Jones, 10 High street, Boston, Mass. Philadelphia, Secretary, L. B. Eichengreen, Broad and Arch streets. Chicago, Secretary, J. B. Jackson, 26 North Market street. Pittsburgh, Secretary, J. C. Mundo, Oliver Building.

Indiana Gas Association.—Annual meeting, March —— —— 1914. Terre Haute. Officers: President, A. S. Cooke, Terre Haute; Vice-President, A. C. Blinn, Evansville; Secretary-Treasurer, Philmer Eves, Indianapolis.

Iowa District Gas Association.—Annual meeting, Davenport, May 27, 28, 29, 1914; Officers: President, B. C. Adams, Lincoln, Neb.; Secretary, G. I. Vincent, Des Moines, Ia.

Kansas Gas, Water and Electric Light Association.—Annual meeting, October—— 1913. ———— Officers: President, L. O. Ripley, Emporia, Kas.; Secretary and Treasurer, W. H. Fellows, Leavenworth, Kas.

Michigan Gas Association—Annual meeting, September 17, 18 and 19, 1913, Detroit. Officers: President, W. S. Blauvelt, Detroit, Mich; Secretary-Treasurer, Glenn R. Chamberlain, Grand Rapids, Mich.

Missouri Electric Light, Gas, Water Works and Street Railway Association.—Annual meeting, April, 1914; Mexico, Mo. Officers: President, P. A. Bertrand, Joplin, Mo.; Secretary and Treasurer, P. W. Markham, Brookfield, Mo.

National Commercial Gas Association.—Annual meeting and gas show, Dec. 1-6, 1913. Philadelphia, Pa. Officers: President, C. W. Hare, Philadelphia Pa.; Secretary, Louis Stotz, 29 West 39th street, New York City.

Natural Gas Association.—Annual meeting, St. Louis, Mo., May 19 and 20, 1914; Officers: President, E. L. Brundrett, Kansas City, Mo.; Secy-Treas., T. Clive Jones, Delaware, O.

New England Gas Association.—Annual meeting, February, 18th and 19th, 1914, Boston. Officers: President, T. H. Hintze, Providence, R. I.; Secretary-Treasurer, N. W. Gifford, East Boston, Mass.

New Jersey State Gas Association.—Annual Meeting, July —, 1913, Asbury Park N. J. President, C. F. Butcher, Freehold, N. J.; Sec'y-Treasurer, O. F. Potter, Newark, N. J.

Ohio Gas Association.—Annual meeting, February ——— 1914, Columbus, O.; President, John M. Garard, Columbus, O.; Secretary, L. B. Denning, Columbus, O.

Oklahoma Gas, Electric and Railway Association.—Annual meeting, Oklahoma City May, ——1914. President, F. E. Bowman, Ada; Secretary-Treasurer, H. V. Bose Oklahoma City.

Pacific Coast Gas Association.—Annual meeting, San Jose, Cal., September 16, 17, 18, 1913. Officers: President, Henry E. Adams, Stockton, Cal.; Secretary-Treasurer, Henry Bostwick, 445 Sutter street, San Francisco, Cal.

Pennsylvania Gas Association.—Annual meeting, Allentown, Pa., April ———, 1914; Officers, President, J. A. Frick, Allentown, Pa.; Secretary-Treasurer, W. O. Lamson, Jr., West Chester, Pa.

Society of Gas Lighting.—Annual meeting Dec., 11, 1913; monthly meetings, second Thursday. Place, New York City. Officers: President, Fred. S. Benson; Secretary, George G. Ramsdell, 29 West 39th street, New York city

Southern Gas Association.—Annual meeting, Mobile, Ala., April 4, 1914. Officers: President, James Ferrier, Rome, Ga.; Secretary-Treasurer, E. D. Brewer, Atlanta, Ga.

Southwestern Electrical and Gas Association.—Annual meeting, May———— 1914, Galveston, Tex. Officers: President, G. H. Gifford, Fort Worth Tex.; Secretary H. S. Cooper, 405 Slaughter Bldg., Dallas, Tex.

Wisconsin Gas Association.—Annual meeting, May ————1914, Milwaukee, Wis. Officers: President, Ewald Haase, Milwaukee, Wis.; Secretary-Treasurer, Henry Harman, Milwaukee, Wis.